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THE DENTAL PRACTITIONER
AND DENTAL RECORD

Vol. XII, No. 4 December, 1961

SEDATIVES AND ANALGESICS IN DENTAL PRACTICE

By C. R. B. JOYCE, M.A., B.Sc., Ph.D.
Department of Pharmacology, London Hospital Medical College, London, E.1

It is usual but unsatisfactory to categorize drugs with actions upon the central nervous system as "stimulants" and "depressants". These terms are unsatisfactory because they imply an understanding of the physiological bases of drug action that we do not possess: neither will they serve as indicators of changed behaviour (the reactions of the whole individual to his external environment). Whatever the direction of the effect of alcohol, for example, upon the central nervous system, observers do not agree whether to call the resulting behaviour "stimulated" or "depressed". Instead of using these ambiguous terms it is better to speak of drugs that modify sensation, motor activity, or such mental accompaniments to behaviour as "emotions".

All these systems are called into operation by stimuli either from the environment or self-generated, and the effect of a drug can therefore be thought of as raising or lowering the threshold over which incoming stimuli must pass in order to initiate activity on the other side. In general, dental surgery is more frequently concerned to raise than to lower such thresholds—the latter occasions usually occur as emergencies and will not be considered further here. Nor shall I be concerned with anæsthesia, either general or local, but with some agents frequently proposed as sedatives and analgesics. The initial statement of a few *general* reasons for caution will lead to economies in space later.

A rough survey of the proprietary drugs available to the medical and dental professions in this country at the moment suggests that these number about 3000 preparations of drugs of all kinds. Some are single substances, but between 30 per cent and 50 per cent are mixtures and may be neglected, for, with a few exceptions, a mixture is a bad form in which to give a useful drug. Not only do individual sensitivities to drugs differ, but the differences vary in direction and quantity from drug to drug. It is arguable if there is even any empirical advantage in giving dexamphetamine together with amylobarbitone: but it is most improbable that a patient who requires twice as much of one will also require exactly twice as much of the other to counteract whatever the latter is supposed to do: or vice versa. Yet this is what the prescriber of the compound preparation is forced to prescribe. He cannot vary the constituents independently. We therefore need concern

ourselves rather little with most mixtures. We can make further economies of effort because in the total of 3000 preparations there are only about 850 separate, *different* chemicals. Some of the differences are minimal and some, we can be sure, produce no change in the therapeutic effect. Of these 850 substances, about a hundred (or one in nine) have primary actions upon the central nervous system: yet one in five of the total of 3000 preparations is for a centrally active drug. Such a situation is typical where ignorance of actions is great and there are only a few reliable drugs: e.g., for rest, the barbiturates and the phenothiazines; for relief from pain, aspirin and the opiate alkaloids. These are substances about which it is worth knowing.

Within the next five or six years about half the products currently advertised will have disappeared from the lists because they are worthless or toxic (Evang, 1960; Joyce, 1961). There is no point in wasting time on the rank and file headed for oblivion: things that have survived longest are best, and we know more about them. Even so, there is remarkably little reliable evidence about the older substances.

The phenothiazines are mentioned in the above paragraph because there is some evidence about their usefulness. Time spent on inadequately tested preparations is wasted unless it is time spent testing them. To do this requires thought, the advice of someone with experience in collecting valid evidence, and a little more information than is to be found in the average manufacturer's pamphlets. These commodities are relatively easy to come by and a great deal could be done by general dental practitioners in this way to relieve the burdens of their patients, their colleagues, and themselves.

An attempt to justify the marketing of a large number of equivalent substances sometimes finds expression in the belief that different patients are suited by different drugs although their pharmacological activity is similar, and that a wide choice offers a better chance of finding one that will suit a given individual. This belief is interesting and may well be true, but the evidence upon which such a rational choice between treatments might be based is at present totally lacking.

The best thing one can say of many new drugs is that they are placebos: of many others it is not possible to speak so kindly. These may be toxic; the frequent claim by manufacturers that no toxicity has been observed usually means that the observations have not yet gone on long enough; occasionally it means that none has been made at all. If a substance really is devoid of all toxic effects it is more than likely that it has no therapeutic effects either, other than those attributable to placebos in general. The symptoms of a great many patients are known to be relieved by placebos—innocuous substances such as lactose, chalk, or saline.

All active drugs are dangerous, and those acting upon the central nervous system particularly—if insidiously—so, despite the prodigality with which they are manufactured, advertised, and prescribed. No doubt pharmacists and pharmacologists, and especially those who teach pharmacy and pharmacology, are largely to blame for the situation. One plain fact is that all centrally active drugs are potentially addictive, and actually so to a small number of users (Isbell and Fraser, 1950). A much larger number of people form the habit of taking the drug, and this, apart from ethical objections, may have consequences as serious for the physiology of the patient as the prolonged use of a crutch following a twisted ankle has for his anatomy. The formation of a habit is quickly accompanied by habituation—the production of smaller effects by the same amount of drug, or the necessity to take larger amounts to produce the same effect—and so a point may be reached when the drug is ineffective against a new challenge. This is no less serious a matter than the better-known and more dramatic toxic effect of many centrally active drugs—death, whether suicidal or too often accidental. Less dramatically, but in the long run perhaps just as importantly, such substances modify the speed and other qualities of everyday reactions. Indeed, to do so is largely their purpose, but at the present time such information as we have about the mode and site of

action of any central drug gives no grounds at all for the comfortable belief that pathological stimuli can be screened and suppressed without disturbing the normal flow of information: prolonged course of treatment, sufficient of the drug may be prescribed at one time to last for the full course. Clearly this amount will not be predictable with complete accuracy,

Table I.—Approved and Proprietary Names of Substances Referred to in the Text as Suitable for Home Use in Dental Practice

Approved Name	Trade Names	Single Adult Oral Therapeutic Dose
Hypnotics		
(Sedatives at 50 per cent of lower dose)		
Chloral hydrate*	Somnos	0·3–2 g.
Dichloralphenazone	Welldorm	0·65–1·3 g.
Quinalbarbitone sodium*	Seconal	50–200 mg.
Pentobarbitone sodium*	Nembutal	100–200 mg.
Amylobarbitone	Amytal	100–200 mg.
Amylobarbitone sodium*	Dorminal	100–300 mg.
Methyprylone	Noludar	200–400 mg.
Glutethimide	Doriden	250–500 mg.
Thalidomide	Distaval	50–100 mg.
Sedatives		
Promethazine*	Phenergan	25–50 mg.
Meprobamate*	Equanil	400 mg.
	Mepavlon	
	Miltown	
Analgesics		
Codeine*	—	10–60 mg
Dihydrocodeine	DF 118	10–30 mg.
Pethidine	Dolantal	25–100 mg.
	Demerol	
Methadone	Physeptone	5–10 mg
Levorphanol	Dromoran	1·5–3 mg.
Dextromoramide	Palfium	5–10 mg.
Ethoheptazine	Zactirin	75–150 mg.
	(w. aspirin)	
Aspirin*		0·3–1 g.
Salicylamide*		1–3 g.
Phenacetin*		300–600 mg.
Paracetamol	Panodol	0·5–1 g.

* Also present in many mixtures (not listed here).

consequently, these substances may lead to death or injury by many indirect routes. Dentists, doctors, pharmacologists, and manufacturers alike should remember that no one is justified in recommending or prescribing sedatives or analgesics over long periods of time without attempting to deal with the underlying cause of the restlessness or pain, or referring the patient to those who will.

Most dentists' prescriptions for substances that bring about rest or freedom from pain are for single doses; wherever possible, this should be the rule. Sometimes, however, as for instance when a nervous patient is undergoing a and so it is better to err safely by underprescribing, despite the temptation to overprescribe offered by the recent changes in N.H.S. charges. Patients too seldom dispose of an excess of pills when the primary purpose of those used has been served. They linger as a reminder, a temptation, or a signpost to accident.

Children are probably the most obvious candidates for drugging by dentists, although we know still less about the effects of drugs upon children than upon adults. Drugs are no substitute for good relationships between patient and practitioner. However, if it is

necessary to give drugs to children, it may be preferable to give them in the form of an elixir wherever possible: pharmaceutical skills disguise most things successfully these days, and few people any longer use the virtue inherent in nasty medicine as a therapeutic aid in its own right. The disadvantage of an elixir, however, is that it is seldom possible to prescribe so small a quantity as a single dose. It is therefore better kept for the prolonged course of treatment already mentioned. Two other questions that are too seldom asked are also relevant to the prolonged course. Is the patient receiving or in the habit of taking other medication, especially that having central effects (and for adults this includes alcohol)? Does he suffer from kidney or liver disease? If the answer to either question is "yes", one should think very hard and make more detailed inquiries before prescribing an analgesic or a quietener for him at all.

To summarize this introduction: many drugs are not drugs at all; all of those that are, are dangerous; some are useful, but few of the many close and none of the exact alternatives have great pharmacological advantages one over the other: convenience of administration and metabolic pathways are points to bear in mind; and amongst non-pharmacological advantages may be considered relative costs to the patient or to the community. We shall now consider some individual examples (*Table I*).

SUBSTANCES THAT QUIETEN THE PATIENT OR RELIEVE ANXIETY: HYPNOTICS

The advantages of a quiet relaxed patient (particularly if a child) are obvious. Apart from the benefit of good personal relations and improved co-operation during surgery, it is now clear that relaxed patients who are free of anxiety experience less pain, even if no analgesic has been given. A good night's rest before operation is a great help, and a hypnotic may therefore be taken the night before.

Bromides.—Although bromides have been regularly denounced since the advent of the barbiturates, and even before that, statements about dosage schedules are still in many recent books and papers. The effects of bromides are slow to appear, slow to disappear, and unpleasant while they last. There is nothing whatsoever to be said in their favour.

Chloral Hydrate.—This is a sleep-inducer whose characteristics are better understood now than when it was introduced a hundred years ago and so it is as safe as any in current use. One to 2 g. are sufficient to give a refreshing sleep. But as an elixir it must be heavily diluted and flavoured to disguise, often imperfectly, the nauseating taste; but more recently, the condensation product dichloralphenazone has been introduced as a tablet that is as effective, weight for weight, as chloral hydrate itself.

Monoureides.—Carbromal and bromvaletone somewhat resemble barbiturates, which are diureides; they also contain bromine, which confers upon them no advantages. They bring about sleep in rather unpredictable doses, and their main claim on our notice is that they were until recently considered so innocuous that they could safely be sold over the counter without prescription. A number of reports about their toxic effects (rashes from carbromal, blood dyscrasias from bromvaletone), addictive capacities, and attractions for would-be suicides eventually led to their inclusion in Schedule 4. From most of the other rest-inducers on that list they are distinguished only by their greater unsatisfactoriness.

Diureides.—The diureides are derivatives of barbituric acid, itself not a hypnotic. The sodium compounds are more soluble and hence more rapidly absorbed. It is customary to divide these substances into four classes, by the reputed duration of their action—customary, but unjustified (Lasagna, 1959; Hinton, 1961). Two classes may perhaps be distinguished, the ultra-short-acting substances (thiopentone and thialbarbitone) and the rest. The "short-acting" (hexobarbitone and quinalbarbitone) certainly differ very little in duration from the "intermediate" (pentobarbitone and amylobarbitone) and the latter probably not at all from the "long" (phenobarbitone and barbitone). They are all, except the last two, excellent hypnotics. Each has an optimally efficient dose that is characteristic of

the drug and of the patient; the same effect will be produced by an optimal dose of one as of another, and nothing will be gained by increasing it. It is traditionally claimed that there are differences in the rapidity with which the effect begins as well as in its duration: this is difficult to measure with electrophysiological apparatus and has seldom even been done without it. Such studies as there are provide no support for the traditional belief. Nevertheless, the metabolic pathways of barbiturates differ as do their rates of excretion. Thus it would be as well to consider the kidneys of a patient for whom phenobarbitone was being prescribed (for those patients taking the other barbiturates, one should think of the state of the liver), if only phenobarbitone were ever prescribed by dentists. There are in fact no indications for its use in dental practice, but its concomitant prescription by the patient's general practitioner must be borne in mind. The effects of all barbiturates add together, as do those of barbiturates taken on top of other substances, such as alcohol, that affect behaviour. Sometimes this combined effect is greater than would be expected from simple addition of the primary effects (Joyce, Edgecombe, Kennard, Weatherall, and Woods, 1959).

"Non-barbiturate" Hypnotics.—These are heterocyclic structures more or less closely resembling the diureides that are being produced in increasing numbers (Lasagna, 1957). Although it is true that in the case of many substances a change in the molecule has led to a change in its actions, or to changes in the ratio of the toxic to the therapeutic dose, this hardly seems to have happened so far in the case of the hypnotics. Methyprylone and glutethimide are effective hypnotics, usually in doses two or three times greater than those required for barbiturates. If their toxicity is not also two or three times greater the higher therapeutic dose does not matter. There is no evidence that the toxicity is greater: nor that it is less. Once again it will take time to get the evidence one way or the other; and simply to prescribe the new drugs without controls is an inefficient way to get it. It is certain, however, that the desire to be modern, even if accompanied by a true desire for knowledge, is not easily justifiable. It is claimed on the basis of animal experiments that thalidomide has a mode of action that is quite different from that of the barbiturates. (Mice are reputedly easily awakened and as easily fall asleep again after this drug, whereas they cannot be roused from a dose of barbiturate sufficient to render them unconscious. It is also said to be impossible to kill laboratory animals with enormous doses of thalidomide. Both observations suggest that there are advantages in the use of the drug in men as well as in mice, but at the moment experimental confirmation in man is lacking.) For the single administration of a hypnotic there is no reason as yet to prefer anything to 200 mg. of quinalbarbitone or amylobarbitone. For repeated administration during a prolonged course of treatment one might seriously consider the use of a placebo (for a suitable patient and a suitable practitioner, because a placebo must be given with the strong and genuinely-held impression that it will be effective; in an unselected sample of patients it will be once in three times, and for the correctly chosen patient, almost every time).

DAY-TIME SEDATIVES

Patients who require pharmacological help to get to sleep the night before a dental operation are presumably likely to need further help during the subsequent day. Although all hypnotics are effective day-time sedatives in smaller doses, many people seem to feel that it is inappropriate to use them for this purpose. It is hard to see why: the effects of 50 mg. of phenobarbitone or 250 mg. of hexobarbitone given by mouth three-quarters of an hour before the work is done are relatively well understood. Those of the "tranquillizers", "ataractics", or "phrenotropics" are not; they are in most cases not different from those of a placebo.

It can be said at once that the phenothiazines, with the possible exception of promethazine, have no place in dentistry. They are scarcely effective upon higher functions in single doses, but do block many autonomic responses. The postural hypotension produced

by chlorpromazine, for example, may be a serious disadvantage. It, and the other members of its family, should be kept for severe mental disturbances, in which they may often be useful. Promethazine, however, like many antihistaminics, causes marked drowsiness. It is thus often employed as a day-time sedative. There is no automatic reason to prefer it to a barbiturate for young children: the clinical tradition that many children are excited rather than quietened by barbiturates is not supported by controlled observations.

Mephenesin and Meprobamate (Laties and Weiss, 1958).—These substituted carbamates relax skeletal muscles by an action upon polysynaptic pathways in the spinal cord and elsewhere. Mephenesin is rapidly oxidized, meprobamate less so. Hence meprobamate may be useful in undoing the physiological knots of a spastic patient, and there is evidence that it reduces the muscle-tone of unstimulated normal subjects and patients. It is far from clear whether this reduction in tone is maintained when a barrage of noxious stimuli is presented; if so, it should be useful in dentistry. In high doses it is hypnotic.

Other Substances.—There are already many other kinds of compound. There will be still many more, and there is little point in describing them. The dental profession introduced at least one of the earliest, now known to be largely devoid of important specific actions; whether this is a matter for congratulation depends upon the point of view. It will be to many of those who admit the virtues and immense power of the placebo but are still not quite confident enough to use it as such, instead of numerous more or less expensive and pretentious substances, to hide the truth from themselves as well as their patients. But it will seem a pity to those who suggest more frankness and courage to hasten the discovery that many new drugs are placebos—and hence to hasten also the arrival of their active successors.

ANALGESICS

Analgesics form a smaller proportion of the total number of branded substances with central activity than do the sedatives, hypnotics, and "tranquillizers"—a third as against about a half. Proportionally far fewer chemicals have analgesic activity, and the number of basically similar compounds is therefore far more. The use of compounds for self-medication in this field is also probably far greater. Nevertheless, the problem can be greatly simplified. There are two main kinds of analgesic: those which are useful in pain with which anxiety is associated, and those for conditions which are irritating but not worrying. About the usefulness of sedatives in the former case something has already been said. It should be emphasized that such drugs are best used as prophylactic analgesics—that is, before the onset of confidently expected pain: although it is probably true that the control of any kind of pain is more successful if the countervailing measure precedes its onset.

Analgesics for Pain associated with Anxiety.—Anxiety develops in proportion to the time elapsing between diagnosis and treatment. In dental practice, there may thus often be a case for using substances with anxiety-alleviating properties before operation. Because such analgesics have other, less desirable properties (they are without exception potentially addictive and depressant to the respiration, and each has additional disadvantages peculiar to itself) it is doubtful if their use is ever to be preferred, in dentistry, to a régime of antecedent relaxation by means discussed above and subsequent analgesia with less powerful substances.

The Opium Alkaloids and their Semi-synthetic Derivatives.—Morphine and, *a fortiori*, heroin are medicines altogether too strong for dentistry, but codeine (which occurs naturally in the juice of the poppy and quite commonly in proprietary over-the-counter remedies) is a different case. Codeine is active when taken by mouth, but the amounts present in codeine compound tablets or their proprietary equivalents are so small that the earlier generalization about mixtures of drugs being bad drugs is not invalidated. There is little if any evidence of one constituent increasing the effectiveness of another, and if the pain is of such a kind as to be controlled only by codeine, an eightfold

increase in the number of tablets eaten (which could in some cases be necessary) would cause 4 g. each of aspirin and of phenacetin to be taken as well; it is usually best to avoid aspirin in such quantities (*see below*). Codeine causes constipation and is for this reason often used to control diarrhœa; it depresses the cough centre and does not cause vomiting. All these are perhaps virtues in dentistry. Dihydrocodeine has fairly recently been introduced as an analgesic of greater power than codeine and with fewer disadvantages. This may be true. It is as yet too early to say.

Other Substances.—Pethidine is the most powerful analgesic routinely used on a large scale in dental practice (in the United States of America). It is not a sedative, and unlikely to cause vomiting or constipation. It also acts like atropine, which may be useful, and depresses respiration. It has often, in company with every other analgesic, been considered not liable to cause addiction, and this undeserved reputation seems to have persisted. Probably for this reason pethidine has been chosen for the purpose by the majority of those few members of the American medical, dental, and nursing professions who have become addicted to drugs; and possibly the same is true in this country as well.

There are many synthetic imitators of the actions of morphine, such as methadone, levorphanol, dipipanone, dextromoramide; ethoheptazine and phenazocine; pholcodine. The first group is powerful, and no more need be said; the second is new, and nothing is known about it; the third is not analgesic, although not without other uses.

Simple Analgesics.—There are two main groups: the salicylates, and the derivatives of coal-tar—the anilines and pyrazolones. The division is not only of historical but also of practical interest, in that the secondary (including toxic) effects of the two groups differ.

Salicylates.—Acetylsalicylic acid (aspirin) is almost the sole important member of the group to be taken orally; salicylamide is also available but is not yet known to possess advantages. It is more expensive than aspirin B.P.; but there are many proprietary forms of aspirin that are more expensive still. These are designed in part to promote rapid absorption (as well as sales) and in part to avoid the "indigestion" which aspirin is prone to cause. It is clear that a speedy onset of action is the more likely, the more readily soluble the substance: hence it seems a good idea to add bicarbonate, as is done traditionally in many households, or to make mixtures with citrate and calcium carbonate. Unfortunately, however, there are observations to suggest that such additions lower the plasma salicylate level. There are also observations to the contrary. About their greater cost there is no dispute. The "indigestion" is nowadays thought to be a more serious problem than had been realized, recent estimates suggesting that up to 70 per cent of otherwise healthy people using aspirin in large, but not unusually extravagant quantities, suffer gastric hæmorrhage (Muir and Cossar, 1959). This finding has spoilt aspirin's reputation for non-toxicity in analgesic doses, and perhaps made vain, for the time being at least, the efforts of those who would reduce its toxicity to zero by "buffering" with glycine, or coating it with enzyme-resistant materials (Editorial, 1959). By both methods, the price is raised and by the latter at least the onset of the effect is delayed.

Coal-tar Derivatives.—It is a matter for regret that some analgesic preparations still available contain such dangerous substances as amidopyrine and phenazone (antipyrin). Phenacetin is almost as powerful and much safer, although there have been reports in recent years from the Continent, where some national groups are apparently as habituated to it as are those of Britain to aspirin, of widespread renal damage probably caused by the drug or by an impurity commonly associated with it. In smaller doses phenacetin often causes methæmoglobinæmia, but this is rarely serious. Although the metabolism of the drug has been relatively well understood for some time it seems only recently to have been realized that one of the main metabolites, N-aceto-para-aminophenol, was itself an effective analgesic. It has consequently been introduced into clinical use under the approved

name of paracetamol and seems at present to be largely free of the toxic effects of its precursors. Time will tell if this is so.

Of the pyrazolones, phenylbutazone has so far proved the most successful, but it is far from harmless and is better kept for acute painful episodes affecting the bones and joints.

"Simple", uncomplicated pain is as private and idiosyncratic a matter as is "simple" tension. It is a remarkable and well-known fact, for which there is actually some evidence (Jellinek, 1946), that different people's headaches yield to different drugs, although for any one individual the effective treatment is remarkably constant. The same may well be true for traumatic pains. Within reason the analgesic of choice is therefore, as is the hypnotic, the drug of the patient's choice: but perhaps it is worth while to point out once more the advantages of the placebo as one of the most powerful substances available and at the same time the safest, and to suggest that it can be used much more widely and honestly in dental practice than is at present the case.

One final suggestion—there is a great deal of work to be done to place clinical dental pharmacology on a solid basis of experimentally verified fact. Only carefully designed clinical trials of new drugs, and in most cases of the old ones as well, can do this, and the general dental practitioner can provide the opportunities for such trials.

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HISTOGENESIS OF REPAIR AFTER MUCOGINGIVAL SURGERY

An investigation of the histogenesis of the repair after mucogingival surgery was carried out on 10 young dogs. A mucogingival flap was reflected and a measured strip excised from the margin in order to leave a predetermined area of bone exposed.

It was found that necrosis of the superficial layer of the exposed bone occurred, and was followed by an undermining resorption with exfoliation of the exposed bone at periods varying from 2 to 14 days after the operation.

Initially, the proliferating connective tissue appeared to go over the corium of the vestibular mucosa, the periodontal membrane, and the lateral margins of the wound. At the sixth day, however, after the resorption of the bone, the granulation tissue from the marrow spaces and the periodontal membrane fused with the other granulation tissue to cover the entire wound. New bone formation occurred and was greatest between the twenty-first and twenty-eighth days. Only one half of the lost bone was rebuilt. The epithelial attachment was situated more apically than on the control site.

The wound was covered with new connective tissue within 14 days and by new epithelium in 21 days. Complete maturation and functional orientation occurred over a period of 6 months.—WILDERMAN, M. N., WENTZ, F. M., and ORBAN, B. J. (1960), *J. Periodont.*, **31**, 283.

A. BRYAN WADE

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RECURRENT MIKULICZ'S APHTHÆ

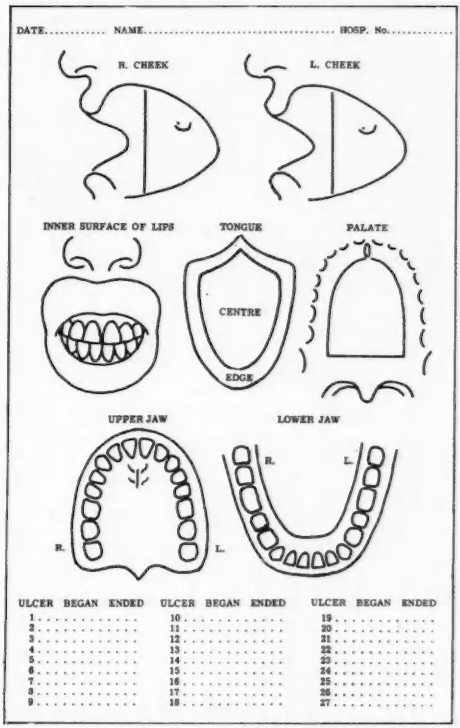
By **BRIAN E. D. COOKE**, M.D.S., F.D.S., M.R.C.S., L.R.C.P.
Reader in Dental Medicine, Department of Dental Medicine, Guy's Hospital, London

IT has recently been demonstrated in a double-blind controlled clinical trial that in the treatment of the Mikulicz's type of recurrent oral ulceration, tablets containing 2·5 mg. of hydrocortisone hemisuccinate given four times a day, in courses of two months, are of value in reducing by half the degree of ulceration, especially during acute exacerbations (Cooke, 1960a). Since another form of recurrent ulceration described under the title of recurrent herpetiform ulcers may be made worse by similar therapy (Cooke, 1960b), it is now an appropriate time to discuss the natural history of Mikulicz's aphthæ as a help in establishing the diagnosis in general dental practice.

Mikulicz's aphthæ is a disease characterized by recurrent crops of one to four punched-out ulcers on the non-keratinized mucosa only. While the aetiology is unknown, there appears to be a close association between the exacerbations of ulceration and mental stress.

The type of recurrent ulceration of the mouth with which this investigation is concerned was first described by von Mikulicz and Kummel in 1888 and again by Sibley in 1899. While it is a common form of ulceration it is not the only one affecting the mouth. Traumatic ulcers occur frequently during the period of the mixed dentition, and again later when dentures are worn. Another type of recurrent ulceration, described under the title of herpetiform ulceration, is characterized by shallow pin-point ulcers on any part of the oral mucosa, superficially resembling a herpetic infection. Some forms of recurrent ulceration are associated with ulceration of other mucous membranes and the skin, and they may be variants of Behcet's syndrome. It is because Sircus, Church, and Kelleher (1957) group these varying types of ulceration as one entity that they conclude that at some period in their life 1 in 5 of the population suffers from recurrent aphthous ulceration of the mouth.

Bacteriological and serological studies by Dodd and Ruckman (1950), Blank, Burgoon, Coriell, and Scott (1950), and Farmer (1958) exclude the herpes simplex virus as an aetiological factor in Mikulicz's aphthæ, and to date no causative organism has been found.


DATE..... NAME..... HOSP. No.....
R. CHEEK
L. CHEEK
INNER SURFACE OF LIPS
TONGUE
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UPPER JAW
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1 . . . . . 10 . . . . . 19 . . . . .
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7 . . . . . 16 . . . . . 25 . . . . .
8 . . . . . 17 . . . . . 26 . . . . .
9 . . . . . 18 . . . . . 27 . . . . .

Fig. 1.—The form on which patients recorded individual ulcers.

The present investigation correlates the case-histories and clinical examinations of 90 patients, 57 of whom are female and 33 male, and in 7 cases biopsies were taken of what were thought to be early lesions. On a specially designed form (*Fig.* 1) 30 patients kept a written record of the time each ulcer lasted,

its site, and relative size for varying periods of time up to a year. Many patients have been followed up for periods of 1 to 7 years. As a cross-section of the population, these patients are intelligent and hard working, but often anxious, worried, and frankly hypochondriacal.

CLINICAL FEATURES

A burning sensation is sometimes felt at the position on the mucosa where, within 12–24 hours, it would feel rough to the tongue before breaking down into an ulcer. Before ulceration, the mucosa is slightly raised and erythematous, but at no stage is a blister to be seen.

The ulcer, at first small and shallow, is exquisitely painful, but after 2–3 days there is an abrupt transition from the pain to discomfort only. The ulcer may enlarge for 4–6 days, reaching 0·5 to 1 cm. in diameter, and is covered with a grey slough. The established ulcer has a crater-like punched-out appearance, with raised red rampart-like margins, and may take 10–14 days or longer to heal. Only the long-standing ulcers heal with a scar. The shape of the ulcer is largely determined by the site, being oval or round on the lips and cheeks, and linear in the buccal sulcus (*Figs.* 2, 3).

Fig. 2.—Seven-day-old Mikulicz's ulcer on lower lip.

Fig. 3.—Fifteen-day-old Mikulicz's ulcer in healing stage on lower lip.

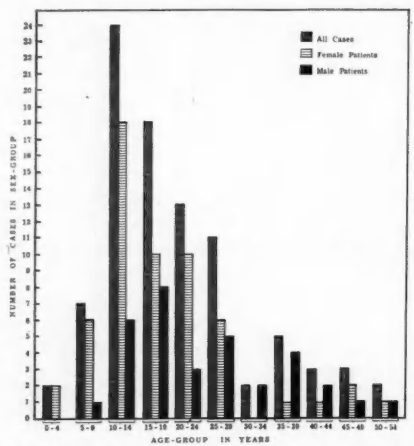

Fig. 4.—The relation between sex and age at the onset of ulceration in 90 patients.

Only rarely are there more than four ulcers present at a time, and these affect the non-keratinized mucosa only. The lower lip, cheeks, buccal sulci, dorsum, and lateral margins of the tongue are affected most commonly. Those ulcers which occur over fibrous and muscle bands, such as the frænum, often last longest and are the most painful.

On occasion, an ulcer will assume large proportions, and the associated pain may interfere with speech and the proper intake of food. Such an ulcer may be 2 cm. in diameter, healing only after many weeks and leaving a depressed scar. Often these very large ulcers form on the scar tissue left by previous ulcers.

Age at Attendance for Treatment.—One-third of the patients presented for treatment in the third decade, with the others almost equally divided between the second, fourth, and fifth decades.

Age at Onset of the Ulceration.—The following points are explained by the accompanying diagram (*Fig.* 4).

1. The highest incidence for both sexes is in the second decade, 50 per cent of the females and 42 per cent of the males.

2. The peak incidence for females is between 10–14 years of age and for males 15–19 years of age.

3. Seventy-three per cent of all patients are in the second and third decades.

Latent Period between Onset of Ulcers and Ulcers becoming Severe.—In many patients there is a definite latent period between the initial onset of the ulcers and their becoming severe. Initially the ulcers may be small and infrequent, but after a varying period of time they become frequent, larger, and take longer to heal. From *Table I* it can be seen that this latent period pertains to the females rather than to the males. In 15 patients it was not possible to decide whether there was a latent period or not.

Table I.—Showing the Latent Period between the Onset of Ulcers and the Onset of the Severe Lesions

Latent Period before Ulcers became Severe	*Males*	*Females*
	Number	Number
Within 1 yr.	19 (68%)	21 (45%)
,, 1–5 yr.	2	10
,, 6–10 yr.	5	8
,, 11–20 yr.	2	5
,, 21–30 yr.	0	3
Total number	28	47

Length of History of Ulceration at Time of Presentation.—Fifty per cent of both sexes give a history of ulceration from 1–5 years, with histories in the other patients ranging from 6–40 years (*Table II*).

Table II.—Showing the Length of History from the Onset of Ulcers to the Time of Presentation

Length of History at Presentation	*Males*	*Females*
	Per cent	Per cent
1–5 yr.	50	50
6–15 yr.	33	20
16–40 yr.	17	30

The Frequency of the Crops of Ulceration.—In 84 patients there is a clear history as to the length of time separating crops of ulcers. While 45 per cent of the males suffer continuous ulceration, only 18 per cent of the females are so affected. Sixty per cent of the females experience either a fortnight's or a month's remission between crops of ulcers. Apart from those patients who suffer continuous ulceration, there is a rhythmic periodicity in the attacks (*Table III*). Careful charting of the ulcers in relation to the menstrual cycle did not show a constant relation between the two for many months in any one patient.

Table III.—The Relation of Periodicity of Ulceration to Sex

Periodicity	*Males*		*Females*	
	Number	Per cent	Number	Per cent
Continuous	13	45	10	18
1–14 d.	4	14	14	25
2–4 wk.	6	21	19	35
4–8 wk.	4	14	6	11
8–12 wk.	2	7	6	11

Seven patients, after a history of severe ulceration for 2, 4, 4, 5, 6, 7, and 12 years respectively, experienced at least a year's complete freedom from ulceration before the ulceration returned at its former severity.

Associated Diseases.—None of the patients has ulceration of the skin. Disturbances of mental outlook such as neuroses, depressed moods, and hypochondriacal behaviour are observed in many patients, but no other disorder appears to be more than a chance finding.

Table IV.—The Factors thought to be Associated with the Onset of Ulcers

Associated Factors	*Number of Patients* (34)
Domestic problems	8
Occupation	11
Financial	1
Marital	1
Illness, accident	6
Bereavement	1
Within six months after pregnancy	6

Family History.—Twenty-two patients (24 per cent) give a history of either a sibling or a parent being affected with recurrent oral ulcers. In only 6 families are 3 or more members affected. In several cases where a parent is affected, the ulcers begin at an early age in the child.

In none of the married patients are the husband and wife both known to have ulcers.

Factors relating to the Onset of Ulcers.—In 34 patients whose ulcers began after adolescence, a definite history is given of mental stress associated with work, domestic life, or ill health (*Table IV*).

Factors determining the Site of the Ulcers.—Trauma is often the localizing factor for these ulcers. In patients whose ulcers predominantly affect the commissures and the lips, the anterior teeth are often the only teeth present, with the result that all chewing is carried out in the front of the mouth. Even when dentures are provided, the patient continues to chew with the anterior teeth, preferring to do so with natural rather than artificial teeth.

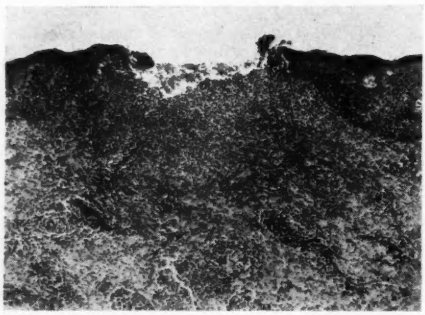

Fig. 5.—Mikulicz's ulcer. Buccal mucosa. Non-specific ulceration. H. and E. (×40.)

Even the most careful handling of the cheeks during routine dental treatment will precipitate a very severe crop of ulcers. Tooth-brush bristles, toast, and other crisp foods often localize ulcers to the buccal sulcus. Teeth out of occlusion and sharp cusps may determine the site of ulcers.

HISTOPATHOLOGY

Small ulcers were excised for histological examination in 7 patients. All biopsy incisions heal in these patients within 2–3 days, whereas the ulcers, if left, might not heal for 12–14 days.

In all cases the histological appearance is that of non-specific ulceration. The epithelial margins of the ulcer are undermined and there is a diffuse chronic inflammatory infiltration in the corium (*Fig.* 5). *Fig.* 6 depicts an area adjacent to a small ulcer, and there is sub-epithelial œdema with the overlying epithelium thinned by liquefaction degeneration, but still intact. Occasionally, the adjacent epithelium shows intra- and extra-cellular œdema, changes consistent with the effects of mild friction, and suggesting that the final breakdown of the epithelium may result from trauma.

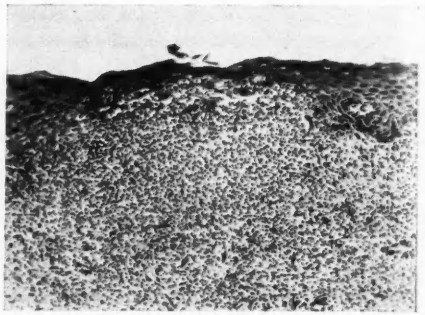

Fig. 6.—Mucosa adjoining a Mikulicz ulcer. Sub-epithelial œdema and the overlying epithelium thinned by liquefaction degeneration, but still intact. H. and E. (×78.)

DISCUSSION

This investigation confirms the findings of Sircus, Church, and Kelleher (1957) and Farmer (1958), in that females are affected twice as commonly as males, and that there is a greater tendency for the ulcers to occur continuously in males, and with a rhythmical periodicity of between 14 days to 1 month in females. Careful charting, however, does not reveal a constant relationship between the periodicity of the ulcers and the menstrual cycle. During pregnancy, ulcers continue in as many patients as are free from ulcers at that time. Nevertheless, bearing in mind that the peak incidence for the onset of ulcers in females is between the ages of 10–14 years, hormonal changes of the menstrual cycle probably influence in part the incidence of ulcers.

Histological studies throw little light on the aetiology of these ulcers. Farmer biopsied early lesions from 31 patients, and in 20 patients the picture is one of non-specific

ulceration. In the other cases he observed changes in the overlying epithelium similar to those attributed in the present study to the effects of friction. It would appear that the primary lesion is in the corium in the form of a chronic inflammatory focus. If the reaction is severe, it is associated with sub-epithelial œdema and liquefaction degeneration of the basal and lower prickle cell layers. The ulcer probably results from slight trauma to the surface of the epithelium. These tentative conclusions are drawn from the fact that the only changes seen in the epithelium are secondary either from trauma to the surface or to the inflammatory reaction in the corium.

Regarding the aetiology of this condition, probably familial and environmental factors are equally important. Sircus and others report 45 per cent of their 120 cases, Farmer 39 per cent of his 121 cases, as giving a family history of a similar type of recurrent ulceration. That 24 per cent of the present series give a similar family history is in support of their findings. However, as Sircus and others point out, the percentage of a familial relationship is too low, in relation to the high incidence of the disease, to suggest that factors of inheritance play more than a minor role in aetiology.

A close relationship between mental stress and this type of recurrent ulceration is found in the present series of cases. Sircus and others, one of whom is a psychiatrist, find that severe environmental or emotional stress immediately preceded the onset of ulceration in 63 per cent of the female and 59 per cent of the male patients. Sibley's account of one of his patients 60 years ago is just as applicable to many patients to-day: "A woman who managed a large household and maintained a very prominent position in society on a very limited income, which was an incessant cause of anxiety to her. The ulceration commenced at a time of unusual mental stress, and continued through many years, in fact during the whole period that the anxiety continued. Of recent years her position has become less embarrassing, and concurrently the ulceration has been less severe."

Trauma by teeth or hard foods appears to be an important localizing factor, and when the brunt of mastication falls on the anterior teeth alone, ulceration is most severe in the region of the commissures and lips.

The transition from exquisite tenderness to discomfort that many patients describe is probably related to the development of a covering slough to the ulcer that is adherent and adequate in thickness to protect the underlying tissues from surface irritation.

Whereas a simple traumatic ulcer heals in 3–4 days, these ulcers take three or more times longer to heal. Yet, if an ulcer is excised, the site of excision heals normally. What it is that prevents these ulcers from healing is just as difficult to explain as why they form at all.

Palliative Treatment.—The range of therapeutic measures that have been advocated for the prevention of recurrent oral ulcers is almost unlimited, and no useful purpose is served by recounting their supposed attributes. Just as the cause of the ulcers is unknown, so is their prevention.

Certain palliative measures are of value, especially if used together with local steroid therapy. The occlusion of the teeth should be such that mastication is performed with maximum efficiency and least trauma to the buccal mucosa. There must be no rough cusps to natural or artificial teeth. An edge-to-edge bite with consequent nipping of soft tissues must be corrected.

When an ulcer first appears, an alum stick may be applied once and only once. The effect is to aid the formation of a protective slough to the surface of the ulcer, with consequent relief of pain. Further applications will only cause necrosis to the epithelial margins of the ulcer.

Secondary infection of the established ulcer is best controlled by two daily applications of 1 per cent gentian violet.

A hard tooth-brush should be avoided. Care should be taken when eating chocolate, which, when it breaks, allows the teeth to meet unexpectedly, perhaps nipping the cheeks. Talking during meals will also predispose to the cheeks being nipped in this fashion.

Lengthy remissions from ulceration are generally associated with improvement in conditions at work or in domestic life. Where the cause of mental stress can be attributed to one such factor, such, for example, as inability to work with a colleague, then a transfer to another department, if it can be arranged, may reduce the severity of the ulceration.

If the ulceration is of recent onset, it is wise to exclude a possible anæmia or diabetes. The correction of any general cause of lowered resistance may materially reduce the degree of ulceration.

SUMMARY

The results of a clinical and histological investigation of 90 cases of Mikulicz's recurrent aphthæ are reported upon and discussed. On a specially designed form, patients kept a written record of the period each ulcer lasted, its site, and relative size for varying periods of time up to a year.

Acknowledgements.—I am very grateful to Mr. J. E. Hutchinson of the Department of Dental Medicine for preparing the histological material and photomicrographs, and to Mr. B. A. Jones, A.I.M.P., of the Dental Photography Department for the illustrations.

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EROSION OF THE TEETH DUE TO SULPHURIC ACID IN THE BATTERY INDUSTRY

During the forming process in the manufacture of batteries groups of lead plates are immersed in dilute sulphuric acid and a direct current of 110 volts passed through them. Bubbles are produced which spray droplets into the air, so that in spite of good ventilation a visible mist may be present. When batteries are charged a similar state of affairs exists save that as the plates can now be covered with a lid, far less acid contaminates the air.

The entire staffs of the forming and charging departments were examined and their teeth compared with similar groups from two other departments which were free from acid. Only those exposed to acid showed etching or erosion of the teeth and only those in the forming shop showed gross lesions.

Lesions appeared on the labial surfaces of the upper and lower central incisors and, to a lesser extent, the canines. The initial lesion was a ground-glass erosion below the line of the slightly parted lips. Gross tooth loss started at the mesial corner and spread across the incisal edge, affecting the labial rather than the palatal surface, until the teeth were out of occlusion. Further loss continued until the lip line was reached. The exposed surface was shiny and hard and the exposed dentine became darkly stained. Only in one case did the pulp become exposed. Usually the deposition of secondary dentine prevented this occurrence. The degree of erosion was related to the length of time spent in the department, the concentration of acid in the air, and the length of the upper lip. A few exhibited rapid erosion and some men appeared to be immune. In all cases the condition was painless.

Differential diagnosis and several possible methods of prevention are discussed.—MALCOLM, D., and PAUL, E. (1961), *Brit. J. indust. Med.*, **18**, 63.

G. R. SEWARD

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A FIBROUS EPULIS IN A BOY AGED THREE YEARS

By **P. C. READE**, B.D.S. (Adel.), F.D.S. R.C.S. (Eng.)
Lecturer in Periodontia, Dental School, University of Adelaide
and **B. G. RADDEN**, B.D.Sc. (W. Aust.), Ph.D. (Lond.), F.D.S. R.C.S. (Eng.)
Senior Lecturer in Oral Pathology, Dental School, University of Adelaide

FIBROUS epulides do not commonly occur in children. They are most frequently seen in adults in their third and fourth decades (Cooke, 1952). Davies (1959) reported the occurrence of a fibrous epulis in a boy aged four years. Previous to this Stones (1954), Bernick (1948), and Sample and Swanson (1945), after observing numerous cases, reported few fibrous epulides in children, and the latter observers stated that they never occur in children younger than six years old.

Fig. 1.—Clinical photograph showing the fibrous epulis in the anterior region between $\overline{A}$ and $\overline{B}$.

CASE REPORT

The patient, R. McG., a boy aged 3 years 4 months, was referred to one of the writers (P. C. R.). The child's mother had observed a small swelling between his lower anterior teeth. The mother claimed that the swelling was first noticed shortly after the eruption of the teeth. It slowly increased in size, and appeared to be separating the teeth.

There was no relevant medical or dental history.

On examination, the child appeared to be healthy and of normal physical development. Intra-oral examination revealed a complete deciduous dentition and normal soft tissues with the exception of the interdental gingiva between $\overline{A}$ and $\overline{B}$ (*Fig.* 1). These teeth were separated and the lateral incisor was distally displaced and slightly rotated. The space was occupied by a firm, pale pink swelling with an uneven surface and measuring 5 mm. high and 4 mm. wide at the base. No local irritating factors in the form of calculus or interproximal caries were detected. Radiographs confirmed the clinical findings and showed no changes in the underlying interdental bone or in the root surfaces of the teeth adjacent to the swelling. A provisional diagnosis of a fibrous epulis was made.

Fig. 2.—A photomicrograph of a section of the fibrous epulis showing proliferating epithelium surrounding the fibrous tissue. H. and E. (× 12.)

TREATMENT.—Under local anæsthesia the swelling was excised from the interdental region with incisions made down to the alveolar bone and including a margin of normal tissue. Healing was uneventful with no indication of a recurrence.

PATHOLOGY.—The fixed specimen consisted of an ovoid, whitish-grey, rubbery, relatively smooth fragment of mucosa (up to 0·4 cm. diameter), with a finely granular cut pedicle (up to 0·4 cm. diameter).

Microscopic examination of the specimen disclosed that it was covered by a layer of stratified squamous epithelium, which in places was undergoing active proliferation (*Fig.* 2). The underlying tissue was composed of a markedly cellular immature connective tissue with a chronic inflammatory cellular infiltration (*Fig.* 3). There were some small isolated areas of epithelial cells lying deep in the connective tissue, but there were no signs of malignant change nor were there giant cells present in any of the sections studied. A diagnosis of a fibrous epulis was confirmed.

DISCUSSION

The histological examination of this swelling showed that it was of the nature of a

fibrous epulis and not a so-called congenital epulis (granular cell myoblastoma) as reviewed

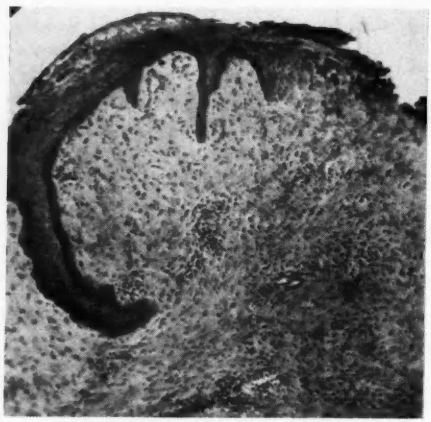

Fig. 3.—Photomicrograph of portion of the fibrous epulis showing the cellular nature of the connective tissue with some small areas of round cell infiltration. There is some proliferation of the epithelium down into the underlying connective tissue. The superficial layers of the epithelium are degenerate. H. and E. (× 48.)

and described by Read and Craig (1959). Nor did it have the characteristics of a congenital pigmented epulis (Willis, 1958).

This case is of interest for three reasons. First, this patient presented with a fibrous epulis at a much younger age than any previously reported cases. Secondly, from the history supplied by the mother, it is probable that the epulis commenced soon after the eruption of the deciduous teeth, and may therefore have resulted from irritation of the gingival tissues during this period of eruption. Fibrous epulides are generally considered to form in response to some local irritation, but in this case none could be found. Thirdly, as in the case reported by Davies, it is suggested that the epulis by its presence and growth accentuated the space between $\overline{|A}$ and $\overline{|B}$.

Acknowledgements.—Our thanks are due to Mr. B. Burfield for referring the case, and to Mrs. L. Zaleski for the clinical photograph and photomicrographs.

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ZINC-OXIDE—EUGENOL IMPRESSION PASTES

This work, carried out at the Commonwealth Bureau of Dental Standards, is referred to as a draft standard.

Proposed Tests.—

1. *General.*—The components shall be uniform, granular-free, of contrasting colours, capable of being dispensed from tubes (if supplied as such) easily at 15° C., mix readily, have a pleasant odour and flavour, separate cleanly from model-casting material, and not burn the mouth tissues.

2. *Consistency.*—This should be such that the diameter of the disk formed is not less than 30 mm. or more than 45 mm. when 0·5 ml. of mixed paste is placed between glass plates and at 2 min. is subject to a load of 1·500 g. The more fluid the paste, the greater will be the diameter of the disk.

3. *Setting Time.*—Tested under mouth conditions with an "initial" Gillmore needle, the setting time shall not be more than 6 min.

4. *Tensile Strength.*—This shall not be less than 3000 g. per sq. cm.

5. *Impression-taking Ability.*—The paste shall record accurately the surface detail of the test block.

6. *Keeping Qualities.*—When the components are stored in their original containers they shall retain the properties detailed in the specification for not less than two years after the date of manufacture.

Results.—The range of products obtainable on the local market was tested, and all the samples complied in their general requirements; the keeping qualities were not assessed, but they are none the less important.—DONNISON, JOAN A. (1960), *Aust. dent. J.*, 5, 262. G. E. B. MOORE

TUBERCULOUS SINUS OF FACE ASSOCIATED WITH AN ABSCESSED LOWER THIRD MOLAR

By P. BRADNUM, B.D.S. (Dunelm.), F.D.S. R.C.S. (Eng.)*
Senior Registrar, Dental Department, Royal Victoria Infirmary, Newcastle upon Tyne

EVEN in advanced cases of pulmonary tuberculosis, when the sputum contains many tubercle bacilli, tuberculous infection of the oral tissues is rare (Fishberg, 1932). The diagnosis of tuberculous oral lesions is particularly difficult in patients in whom the presence of phthisis is not suspected.

CASE REPORT

Mr. N. B., a labourer aged 32 years, was referred to this department by his general medical practitioner having developed a painful swelling of the left angle of his mandible 2 weeks previously. His previous treatment had consisted of a course of oral penicillin, which had produced an initial improvement of the condition, although the swelling did not subside completely. Ten days after consulting his doctor the swelling began to increase in size, and 4 days later he attended this hospital.

Fig. 1.—Tuberculous infection of left cheek.

ON EXAMINATION.—Examination revealed an ill and obviously toxic well-built man, with an oral temperature of 100·2° F. In the soft tissues overlying the left angle of his mandible a bright red, tender, fluctuant swelling was present, in the centre of which there was an area of tense, thin skin. Despite severe trismus intra-oral examination revealed the presence of a carious, partially erupted $\overline{8}$, and an inflamed swelling was seen in the buccal sulcus alongside this tooth.

No history of hospital admissions or serious illness was elicited on direct questioning. A lateral oblique radiograph revealed an area of apical rarefaction associated with $\overline{8}$, and a diagnosis of acute alveolar abscess associated with this tooth was made.

The patient was given a mega unit of crystalline penicillin and 600,000 units of procaine penicillin by intramuscular injection. The $\overline{8}$ was extracted, the abscess incised extra-orally, and a rubber drain inserted under general anæsthesia. Two hours later the patient was allowed to return home. Three ml. of pus were sent for bacteriological examination and produced a moderate growth of hæmolytic streptococci, sensitive to penicillin. The next day the patient's general condition was much improved, the drain was removed, and a further injection of penicillin given. Arrangements were made for the patient's doctor to continue the antibiotic therapy for a further 3 days. When seen again, one week after drainage, the swelling had almost subsided, but some residual induration of the soft tissue was present. The patient failed to keep his next appointment, but attended 2 weeks later with a recurrence of pain and swelling in the same area.

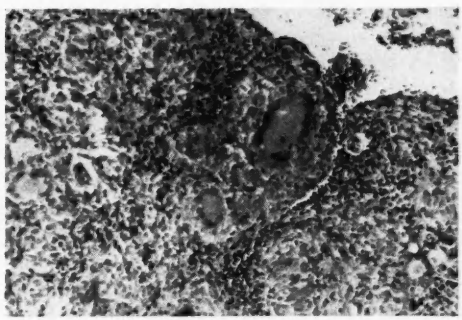

Fig. 2.—Photomicrograph showing tubercles with epithelioid and giant cells.

On this occasion an incision under topical refrigeration anæsthesia released a small amount of thin, watery pus, from which a penicillin-resistant strain of *Staphylococcus aureus* was cultured. A course of achromycin and vitamin B was then prescribed. Once again the patient failed to attend for treatment. When he did report 2 weeks later a discharging sinus was present in his left cheek (*Fig.* 1).

A provisional diagnosis of cervicofacial actinomycosis was then made, and under general anæsthesia the sinus was explored and some granulation tissue removed for pathological and bacteriological examination. Culture of the granulation tissue produced a moderate growth of penicillin-resistant *Staphylococcus aureus*.

PATHOLOGY.—Pathological examination was more rewarding. The pathological report on the specimen (*Fig.* 2) was as follows: The material consists of several small fragments of tissue and blood-clot. Histologically the tissue shows numerous, closely-packed tubercles with epithelioid and giant cells. The majority of the tubercles show no evidence of caseation. In one area of the material examined there is definite caseation, so the

* Now Consultant Oral Surgeon, City General Hospital, Carlisle.

diagnosis of tuberculosis cannot be doubted. Tubercle bacilli could not, however, be demonstrated in the sections.

RADIOGRAPHY.—A radiograph of the chest demonstrated a radiolucent lesion in the left apical area, which was thought to be due to early active tuberculosis. When the patient was informed that he had a lung disease he volunteered the information that he had attended a chest hospital for three years (1955–8) with sarcoidosis of the lungs, and added that he had not bothered to attend for over a year. He was immediately transferred to the hospital concerned. As an examination of his sputum showed the presence of tubercle bacilli he was admitted to a sanatorium. Within one week of starting antitubercular treatment the sinus of his face ceased to discharge and has since remained healed.

DISCUSSION

Pulmonary tuberculosis is notoriously difficult to diagnose on clinical examination, and it is hardly surprising that its presence was not detected by the anæsthetist during his routine pre-anæsthetic examination. It is, however, well known that tuberculosis is a possible sequel to sarcoidosis of the lung. Riley (1950), in a study of 52 cases of Boeck's sarcoid, found that 25 per cent developed active tuberculosis in under 5 years. Oral surgery is contra-indicated in cases of active pulmonary tuberculosis, as infection of the jaws may follow direct inoculation of the mucosa by contaminated sputum (Cohen, 1959). In this case, tuberculosis could have been a secondary infection complicating an initial streptococcal abscess, the tubercle bacilli entering the tissues through the $\overline{|8}$ socket. Meng (1940), in a review of 14 cases of tuberculosis of the mandible, states that a typical acute inflammatory swelling was never observed. In his series all but 2 patients had facial sinuses, with little surrounding tissue reaction. An ulcerative lesion of the mucous membrane which was indicative of tuberculosis was found in 1 case only.

Some patients are unwilling to admit to previous chest infections, and many consider pulmonary tuberculosis to be a form of social stigma. Thilander and Wennström (1956) describe a patient with a tuberculous fistula of his face who denied any serious illnesses, even though he had been in a sanatorium 5 years earlier with pulmonary tuberculosis.

Though a rare cause, tuberculosis must be considered in the differential diagnosis of a chronic discharging sinus of the face. Definitive diagnosis may be impossible without biopsy.

SUMMARY

A case in which facial tuberculous infection complicated an acute abscess associated with $\overline{|8}$ is recorded. Attention is drawn to the difficulties in diagnosis, especially when the patient suppresses a history of chest infection.

Acknowledgements.—I wish to thank Professor G. L. Howe, Sutherland Dental School, for his help and advice in the preparation of this communication, and Dr. R. O. K. Schade, Royal Victoria Infirmary, for the pathological report and photomicrograph.

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ROENTGENOGRAPHIC AND DIRECT OBSERVATION OF EXPERIMENTAL LESIONS IN BONE

A number of human mandibles were subjected, post mortem, to cutting with diamond burs, reamers, and dental burs. The artificial lesions thus produced were examined radiographically under standard technique and the results compared with appearance seen from direct observation of the sectioned jaws.

It was found that lesions were detectable radiographically only if the cortical bone was affected either by complete perforation or by extensive erosion of the inner or outer surface of the cortex.

Apparent cancellous destruction seen on radiographs is due to the erosion of the innermost surface of the cortical plate. Lesions solely in cancellous bone cannot be detected radiographically.—BENDER, I. B., and SELTZER, S. (1961), *J. Amer. dent. Ass.*, **62**, 152.

J. R. GRUNDY

A STUDY OF THE PREVALENCE AND SEVERITY OF GINGIVITIS IN UNDERGRADUATES AT LEEDS UNIVERSITY (1960)*

By **R. TAYLOR HEYLINGS**, M.B., Ch.B., B.Ch.D., L.D.S.

ALL new undergraduates arriving at Leeds University are required to undergo a medical examination which includes a dental examination.

Advantage was taken of this in 1960 to carry out a survey of the prevalence and severity of gingivitis in this sample of the population.

The actual sample comprised 277 females and 874 males, a total of 1151 students whose average age was 18·61 years (*see Table I*).

Table I.—NUMBERS OF FEMALE AND MALE STUDENTS IN DIFFERENT AGE-GROUPS

	Students' Ages at Time of Survey				
	17–18 yr.	18–19 yr.	19–20 yr.	20+ yr.	Total
Females	29	189	46	13	277
Males	57	474	229	114	874

The average age of the total sample was 18·61 years.
The total number in the sample was 1151.

Before the survey was undertaken, the methods used in the past for similar surveys of severity and prevalence of gingivitis were reviewed (King, 1940, 1945; King, Franklyn, and Allen, 1944; Linghorne and others, 1946; Schour and Massler, 1947; Marshall-Day, 1951, 1955; Russell, 1956; Sandler and Stahl, 1954; Ramfjord, 1959; Dunning and Leach, 1960).

Although many of these had much to commend them, most were unsuitable for one reason or another, as the conditions under which this survey was to be carried out demanded a method which was both simple and rapid. This was essential as the dental examinations had to synchronize with medical examinations and only four minutes could be allowed for each dental examination. At least two minutes of this were taken up with the charting of the caries present in the teeth; thus only two minutes were available for consideration of the gingival health. This excluded the use of such systems as Ramfjord's (1959) or Galloway's (1960), which required five and fifteen minutes respectively for each examination, and it also meant that there was insufficient time to use systems such as those of Russell (1956) or Dunning and Leach (1960) which include identification and measurement of periodontal pockets. Moreover, as no radiographs were available, methods requiring these could not be utilized (Dunning and Leach, 1960; Galloway, 1960).

It was therefore decided that a modification of the method used by Schour and Massler in 1947 would be most suitable.

METHOD

The interdental papilla, the adjacent marginal gingiva, and the attached gingiva of each interdental unit were studied in the labial segments including the premolar and incisal regions of both upper and lower jaws. King (1940, 1945), King, Franklyn, and Allen (1944), and Schour and Massler (1947) all agreed that examination of the anterior gingival segments could give results comparable with examination of the whole mouth, and so it was considered justifiable to omit the molar segments from the survey, thus saving much time.

* Given at the meeting of the British Society of Periodontology held on April 22, 1961.

Attention of the examiners was purposely directed to the interdental areas, as it is in these areas that gingivitis and periodontitis advance most rapidly (Waerhaug, Lovdal, and Arno, 1958; Cohen, 1960). A simple form of charting was used, with squares representing the gingival units in the interdental areas, and the examiners were asked to note in these

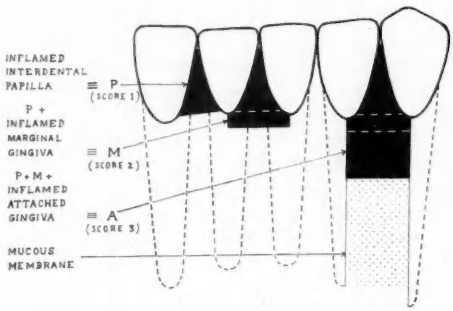
INFLAMED INTERDENTAL PAPILLA
≡ P (SCORE 1)
P + INFLAMED MARGINAL GINGIVA
≡ M (SCORE 2)
P + M + INFLAMED ATTACHED GINGIVA
≡ A (SCORE 3)
MUCOUS MEMBRANE

Fig. 1.—The subdivisions of the gingiva used in the survey, and the three symbols P, M, and A to record inflammation of these areas. The score allotted to each symbol during analysis of the results is also shown. (*Adapted from Schour and Massler*, 1947.)

squares any gingivitis, using the symbols P, M, or A to indicate the extent of the inflammation.

P indicated that the inflammation was confined to the papillary gingiva. M indicated that the inflammation was confined to the papillary and attached marginal gingiva. A indicated that the inflammation had extended to include the papillary, marginal, and attached gingiva (*see Fig.* 1).

The examiners were asked to record whether the type of inflammation was acute or chronic in nature, and the following criteria were suggested:—

Acute Gingivitis: A short history of pain in, and bleeding from, the gums for a few days only, associated with tender, reddened, and perhaps ulcerated gingivæ and also sometimes with regional adenitis and general malaise.

Chronic Gingivitis: A history of bleeding from the gums on eating or brushing the teeth, for some time (weeks or months), associated with gingivæ which were swollen and dull red in colour and bled readily, showing loss of stippling.

These criteria were similar to those used by King (1945) and Schour and Massler (1947).

The examiners were also asked to give each student an oral hygiene rating of "Good", "Fair", or "Poor", and here also certain criteria were suggested:—

Good: A well-cared-for mouth with no untreated carious teeth, no calculus, no staining of teeth, satisfactory tooth-brush technique, and the patient interested in maintaining oral cleanliness.

Fair: Some calculus, some early caries needing attention, some staining of teeth, tooth-brush technique not as good as it could be, and the patient interested in improving oral cleanliness.

Poor: A neglected mouth, much calculus, much untreated caries, much staining of teeth, tooth-brush technique very poor or non-existent, and the patient not interested in maintaining oral cleanliness.

The inspection was carried out by senior dental students, all of whom had completed a year's attendance in the Periodontal Department (one half day per week), and all of whom were within six months of sitting their final examination. They had all received instruction in the method of examination and recording, and as the examination was so simple, it was considered that they had sufficient skill to carry it out. (Greene, in 1959, pointed out that if the examinations were kept sufficiently simple, it was unnecessary to have highly skilled examiners.)

Method of Analysis of Results.—It was decided to allot each undergraduate with gingivitis a P.M.A. score (adapted from Schour and Massler, 1947). This was obtained by allotting a score of one for each square on the chart marked P, two for each square marked M, and three for each square marked A (*see Fig.* 1). The total P.M.A. score for each undergraduate was then arrived at by adding together these numbers. Having done this it was then possible to grade the cases into Mild, Moderate, and Severe. Cases with a P.M.A. score of 1–6 were graded as Mild, cases

with a P.M.A. score of 6–12 were graded as Moderate, and cases with a P.M.A. score over 12 were graded as Severe.

Table II.—A Comparison of the Prevalence of Gingivitis in Females and Males

Females 277 examined	No. with gingivitis	28
	Per cent of females	10·11
Males 874 examined	No. with gingivitis	237
	Per cent of males	27·12

It was also possible to calculate an average P.M.A. score for the females and males respectively by adding together all the P.M.A. scores in each group and dividing these by the number of persons in the respective groups. Also, an average P.M.A. score for the whole sample could be calculated.

FINDINGS

Only one case of acute gingivitis was seen (and this was of the non-specific type) so that, to all intents and purposes, gingivitis as discussed below refers to chronic gingivitis.

It was found that, if the whole sample was considered, gingivitis was over twice as prevalent in male students (27·12 per cent) as in females (10·11 per cent) (*see Table II*) and, moreover, that amongst the male students a much higher percentage (9·5 per cent) had severe gingivitis (P.M.A. score greater than 12) than was the case with the females, for whom the percentage with severe gingivitis was only 0·72 per cent (*see Table III*). Moreover, when the average P.M.A. score for males was calculated it was found to be 3·0 which was over six times as large as the average P.M.A. score for females which was 0·46. These results show a similar trend to those of Marshall-Day (1955), who found in the age-group 19 to 22 years that the prevalence of gingivitis in the males was nearly twice that in the females.

Table III.—A Comparison of the Severity of Gingivitis in Females and Males

	Mild Gingivitis (P.M.A. score 1–6)	Moderate Gingivitis (P.M.A. score 6–12)	Severe Gingivitis (P.M.A. score 12+)
Females 277 examined; average P.M.A. score 0·46	19 (6·86 per cent)	7 (2·53 per cent)	2 (0·72 per cent)
Males 874 examined; average P.M.A. score 3·00	84 (9·61 per cent)	70 (8·01 per cent)	83 (9·50 per cent)

Table IV.—A Comparison of the Oral Hygiene Ratings of Females and Males

	Good Oral Hygiene	Fair Oral Hygiene	Poor Oral Hygiene
Females Total No. examined 277	184 (66·42 per cent)	86 (31·05 per cent)	7 (2·53 per cent)
Males Total No. examined 874	176 (20·14 per cent)	592 (67·73 per cent)	106 (12·13 per cent)

Further analysis of the whole sample revealed that whereas amongst the male students the majority (67·7 per cent) had only Fair rating for oral hygiene, amongst the females the majority (66·4 per cent) had a Good rating (*see Table IV*). This trend was present in all the different age-groups.

Having established the above, the relationship between the oral hygiene rating and the prevalence of gingivitis in the individual students was analysed. It was found that of all students with Good oral hygiene only 1·39 per cent had gingivitis, and the average P.M.A. score was only 0·14, whereas amongst those students with Poor oral hygiene 70·8 per cent had gingivitis, and the average P.M.A. score was 10·88.

Table V.—Prevalence and Severity of Gingivitis in Students grouped according to Oral Hygiene Rating

Good Oral hygiene 360 students. Average P.M.A. score 0·14	No. with gingivitis	5
	Per cent of students with good oral hygiene who had gingivitis	1·39
Fair Oral hygiene 678 students. Average P.M.A. score 2·17	No. with gingivitis	180
	Per cent of students with fair oral hygiene who had gingivitis	26·55
Poor Oral hygiene 113 students. Average P.M.A. score 10·88	No. with gingivitis	80
	Per cent of students with poor oral hygiene who had gingivitis	70·80

To test the validity of these results, the groups examined by different examiners were considered as separate samples, and these showed similar trends to those of the total sample.

CONCLUSION

In the sample of the population considered (undergraduates, average age 18·61 years), the females appeared to take much better care of their mouths than the males and the average female had better gingival health (average P.M.A. score 0·46) than the average male (average P.M.A. score 3·0).

When the average P.M.A. score for the whole sample was calculated by the above method it was found to be 2·43.

The marked difference between females and males may be the result of greater emphasis having been laid on the importance of oral hygiene and æsthetic values during their education. If this is the case it augurs well for the success of current dental health campaigns.

Addendum.—In view of the publication since this paper was read of the World Health Organization Technical Report No. 207 on Periodontal Disease, the author feels that in future the indices recommended by the World Health Organization should be used whenever possible, so that the data collected in various parts of the world may be more readily comparable.

Acknowledgements.—Help given and interest shown by Professor F. E. Hopper were much appreciated, as was the help from other members of the staff of the Leeds University Dental School and Hospital.

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BOOK REVIEWS

THE CLASSIFICATION AND TREATMENT OF INJURIES TO THE TEETH OF CHILDREN. By Roy Gilmore Ellis, B.D.S., D.D.S., M.Sc. (Dent.), F.D.S. R.C.S. (Eng.), Dean of the Faculty and Professor of Operative Dentistry, Faculty of Dentistry, University of Toronto. Fourth Edition. $7 \times 4\frac{3}{4}$ in. Pp. 250, with 164 illustrations. 1960. Chicago: The Yearbook Publishers Inc. (London: Interscience Publishers Ltd.) 34s.

It is no surprise that this well-established and most useful little book is now published as a fourth edition, for it has become well known to dental teachers and all those interested in the dental problems of children since it first appeared in 1945. The author has been wise in not attempting to expand it into a much larger treatise, and, indeed, it is just a few pages shorter than the original edition.

One is struck throughout by the common sense and experience that lie behind this work, which covers very well the many varied types of accidents which may happen to the incisors of children, and the book is still based on its original description as the "Classification and Treatment of Injuries to the Teeth of Children". Dr. Ellis's classification is well known and it is mainly on his various degrees of classification that your reviewer finds himself in some disagreement with the author. His first five classes are generally and widely accepted, but his sixth class, which involves fractures of the root, surely could be questioned as justifying a separate class, since not infrequently such fractures can be combined with Classes 1, 2, 3, and 4. Problems of Class 8, where fractures of the crown *en masse* are usually a further complication of Class 7, and most of the injuries of the deciduous teeth which are classed separately as Class 9, can still be classified under the first five classes with Class 6 or Class 7 again superimposed. It may even be doubtful whether it is justifiable to take a mere crown classification of fracture as an indication to prognosis and treatment, because of the often unassessable degree of subluxation which is always present to some extent and which is really the factor in determining long-term success or otherwise.

The general format of the book, its layout, and its illustrations are the same as formerly and Chapters 6–9 are exactly the same as in previous editions.

Some new text has been added to bring treatment into line with present-day methods and material, such as the technique for restoration with pin inlays (pp. 40 and 41), the use of self-curing plastic to form temporary crowns (pp. 49 and 50), the use of combined gold acrylic crowns (pp. 51–60), and other various modifications in the detailed stages of operative treatment.

Some addition to the chapter on Class 3 fractures of the crown with pulp exposure would be very useful, particularly some account or speculation upon the pulpal response after pulpotomy and the significance and value of dental bridges and the time they take to appear.

The bibliography at the end of the chapters has for the most part not been brought up to date as much as might have been expected. For example, in the Introduction on p. 19, the original wording "in a recent survey . . ." is used as in the original edition. This survey relates to that of Sweet in 1942 and cannot be considered, therefore, as still recent, and in fact the only additional references to this chapter are those of T. E. Lewis, 1959, and S. B. Finn, 1957.

One point to which attention could be provided, and which has never been mentioned in this book, is that of the intrusion of portions of fractured tooth in the soft tissues. All dentists regularly dealing with fractured teeth meet from time to time a portion embedded either in the tongue or in the lip. This may exfoliate but usually it needs removal surgically, so that whenever a portion of tooth is missing and particularly where there are soft-tissue contusions, a search should be made to

establish by radiographic means or probe whether it is embedded in the lip or tongue.

A few new illustrations have been added, but for the large part they are the same as those in former editions and some of the illustrations undoubtedly could be improved in definition and quality. It is doubtful whether some of the new ones showing open-faced gold crowns on pp. 26, 70, and 71 can really commend this method very much in view of the very poor æsthetics of this restoration which would certainly have to be replaced as the child grows older and further gingival recession and eruption take place.

Notwithstanding these minor comments this little book will continue to find its way into the libraries of all those interested in dealing with this most important problem in pædodontics and to be perused regularly for the extraordinary amount of very practical information it contains.

G. E. M. H.

NOYES' ORAL HISTOLOGY AND EMBRYOLOGY. Edited and revised by ISAAC SCHOUR, B.S., D.D.S., M.S., Ph.D., Sc.D., Professor of Histology and Head of Department and Dean, University of Illinois College of Dentistry. Eighth Edition. $9\frac{1}{4} \times 6$ in. Pp. 440, with 295 illustrations and 21 plates, 12 in colour. 1960. London: Henry Kimpton. 86s.

THE number of illustrations in the new edition of this well-known work has been reduced by 167, and the pages by 8. The original plan of Dr. F. B. Noyes, "to keep the book a simple and straightforward statement of current conceptions of the structure and functions of the tissues", has, except for certain parts, been followed. Some of the old illustrations and figures have been replaced and there is some rearrangement of the chapters and illustrations. Two new chapters have been added, one on "The Temporomandibular Joint" and the other on "Experimental Dental Histology". This latter, however, is more or less abstracted from Chapter XXIV on "Comparative Dental Histology" in the previous edition.

In the text there are some interesting, but unwise, changes in nomenclature, e.g., the periodontal membrane is now called the periodontal ligament, and the enamel organ is called the odontogenic organ. The old and new terms are used together in a manner likely to confuse the student reader.

On p. 85 a paragraph dealing with the primary cuticle has had some sentences transposed in printing. In Chapter 5 the section dealing with calcification of the enamel is unsatisfactory and confusing. While the theory postulated by Diamond and Weinmann, now disproved, has been eliminated, the new knowledge has not been adequately stated. In Chapter 6 the same confusion as in the last edition is repeated regarding rod sheaths and inter-rod areas; thus, in Figs. 63 and 61 the dark line round the rod is called the rod sheath in one and in the other the interprismatic substance. In Chapter 8, on the structure of dentine, no mention is made of the now established calcified nature of the wall of the tubule. The chapter on "Dental Caries" is of the pre-war era.

The present edition is an improvement on the previous one, but not as up to date as one would like. It is a matter of opinion whether text-books on histology should include material concerning surgery and pathology. Students, in this country at least, are not likely to consider these aspects whilst doing their histology; the chapters and pages so utilized would be put to better purpose by increasing the information on the histology of the mouth and its structures. The inclusion of information on the oral structures of the dog and hamster and more information on the guinea-pig and rat would be of help to young research workers.

The final chapter on "Laboratory Exercises" is similar to the seventh edition, but the number of periods has been reduced from 25 to 12. The usefulness of these to students in this country is doubtful.

A book which enters its eighth edition is one for which there is a continued demand. The eminence of the author and the good illustrations and production of this work ensure its place amongst the books recommended to students.

J. J. H.

ANCHORAGE CONTROL IN SPACE CLOSURE

By G. G. T. FLETCHER, L.D.S., D.Orth. R.C.S.
Eastman Dental Hospital

IT is the purpose of this paper to uncover the mechanical principles that are fundamental to accurate control of space closure, and to show where such control is needed.

Complete space closure may be, on occasions, a necessity, whilst at other times it need be no more than an incidental objective. Nevertheless, the systems of anchorage control to be outlined herein are the same, and still of importance, whether or not complete space closure is ultimately intended.

The problems that arise are dependent upon the amount and type of tooth movement to be carried out mechanically and the resultant reciprocal effect upon available anchorage. In practice, these problems will range from simple to complex, according to the relative difficulty of anchorage control in any given circumstance.

In gradually building up understanding of the implication of the above paragraph, an effort will be made not to obliterate basic reasoning and objectives beneath a welter of technical detail. Design of individual appliances may be important in the long run, but is secondary to fundamental principles.

The treatment of overcrowding in Angle's Class I cases provides a suitable introduction to the problems of anchorage control. In this type of case space must be gained to accommodate the malalined teeth. If, as is likely, the choice of expansion laterally or anteroposteriorly is debarred by an inadequacy of bone base and the influence of surrounding musculature, space must be obtained by extraction. Sufficient whole units must be removed so that the remainder can be moved into alinement without seriously altering the original mean arch dimensions. The choice of which units should be extracted, how many, and from what parts of the dental arches, is theoretically unrestricted. In finalizing his selection, the orthodontist will be guided by certain general considerations:—

1. Maintenance of symmetry, balance, and appearance of the upper and lower front six teeth.

2. Promotion or maintenance of symmetry throughout the dental arches.

3. Promotion or maintenance of occlusal harmony.

4. Promotion of the simplest forms of tooth movement consequent upon extraction, i.e., reduce to a minimum the number of teeth to be moved, and avoid, as far as possible, need for apical or bodily movement.

5. Promotion, by suitable segmentation of the arches, of an anchorage balance which is in accord with the intended tooth movement and selected appliance method.

The sum of these considerations, when applied in practice, will lead to many and varied choice of extractions. It is fortunately not necessary to consider all these variations, since the quite common choice of the first premolars, in association with Class I overcrowding, provides a suitable introduction to the space closure problem, first, in its simple, and then complex form.

If first premolars are extracted in such a condition, one of three situations will be produced, namely, where the space created is (1) less than, (2) equal to, or (3) exceeds the space required for the alinement of the remaining teeth (*Fig.* 1).

For the sake of simplicity, only one dental arch has been represented in the diagrams, and the reader should assume that the opposite arch presents an identical problem, and that, at this stage, cases of normal dental base relationship are being considered. In *Fig.* 1 A, B, C, geometrical rather than anatomical figures have been used to represent the teeth, and thus to emphasize that the teeth

Given at the meeting held on March 13, 1961.

have been rearranged geometrically and no account has been taken of possible anchorage shift.

Anchorage behaviour must be superimposed on the purely geometrical calculation at the pre-treatment planning stage. All natural factors pertaining to anchorage, together with expected reactions of various appliance methods, must be mentally prejudged in relation to all possible extraction choices with a view to obtaining the result shown in *Fig.* 1 D. Such an ideal result may come about in practice through treatment planning and subsequent mechanics that are easy or difficult, the decisive factor being the nature of the original condition.

If only for later comparison's sake, a glance at space closure in its simplest form is justified (*Fig.* 2).

The mechanical problem in this case is one of preservation of anchorage stability. Neither the anterior nor posterior segments can be allowed to encroach on the space created whilst the intervening teeth are moved into alinement. So long as these tooth movements are of the simple tilting variety, little stress will be put on the anchorage. Little, if any, space need have been created beyond that strictly required for alinement. No appliance need be used beyond a removable or labio-lingual type which possesses a rigid "body" of acrylic or stout archwire, and facility through auxiliary springs to tilt the teeth into position. Space closure in this instance is automatic, following general alinement.

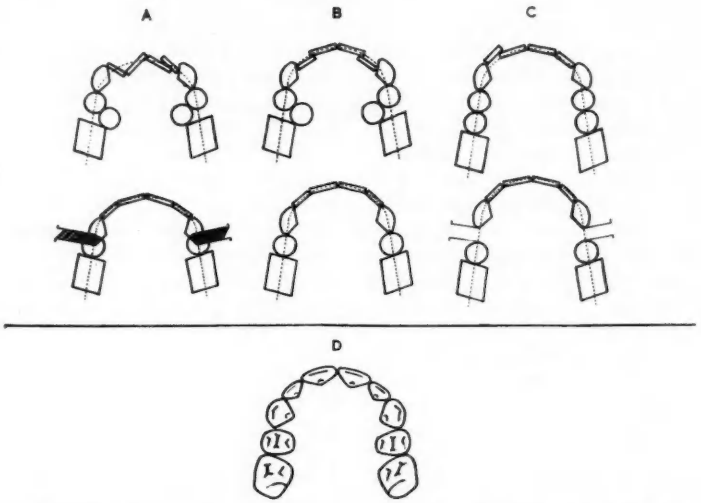

Fig. 1.—Illustrates the geometrical rearrangement of the units of one arch following removal of first premolars. The dotted line is intended to represent the theoretical centre of the zone of muscular equilibrium. Space created in A is inadequate for alinement, in B the space is correct, and in C there is residual space following alinement. The significance of these three situations is explained in the text.

Once simple tilting is replaced by the need for apical repositioning or bodily movement, strain on anchorage is increased. Potential resultant shift of anchorage must therefore be either allowed for or prevented.

To make allowance necessitates the provision of additional compensatory space over and above that required for alinement.

Prevention means the introduction of a stabilizing counterbalance by use of extra-oral traction and often the reduction in quantity of simultaneous tooth movement in any one direction. These latter measures, even if

eventually successful, are cumbersome, and reduce treatment progress to a crawl.

It is desirable, even with simple rigid appliances, to create enough space to allow for the full action and reaction to take place concurrently. In such circumstances these appliances can work fully reciprocally to the limit of their several capacities.

So long as space created is ideal in quantity and so located as to harmonize with the actions and reactions of chosen appliances (i.e., ideal anchorage balance) all well and good, and the simpler those appliances the better. The fact that whole units have to be removed, not halves or fractions of units, in combination with innumerable circumstantial issues, promotes situations where location and/or quantity of extraction space is not ideal.

Details of a case are included at this stage as a moderate example of how circumstances can lead to the non-ideal. It will be seen that first premolar extraction created space far in excess of requirements. Alternative extractions gave the prospect of difficult or lengthy treatment.

This case was treated erroneously, and an alternative method is suggested. Neither the actual treatment nor yet the suggested alternative, with which some may disagree, is as significant as the difficulties and principles of anchorage control that are raised. The case is included solely with a view to provide an illustrative example which, being practical, may make the problems more comprehensible to many than pages of theoretical argument (*Figs.* 3–5).

From the data given in *Figs.* 3–5 it will be seen that this patient had a near normal occlusal formation on a mild Class III dental base relationship. There existed a small discrepancy between bone and tooth tissue resulting in a minor degree of overcrowding. In the lower arch $\overline{1\text{–}4}$ were affected by minor displacements and rotations, whilst the remainder of the arch was well alined. In the upper jaw a similar lack of space was confined in its effect almost wholly to $\underline{2}$ which was displaced labially and rotated to a considerable degree. It was the position of this tooth that was the concern of the patient, who had, at the time, aspirations to television and film acting. There was no doubt that this tooth was more unsightly, particularly in overhead artificial light, than is suggested by the plaster models. The lips were kept firmly sealed at rest, and, on such facial expressions as smiling, lateral contraction took place a fraction of a second before elevation. The act as a whole produced a strong backward pull on the incisors, a feature worthy of more consideration

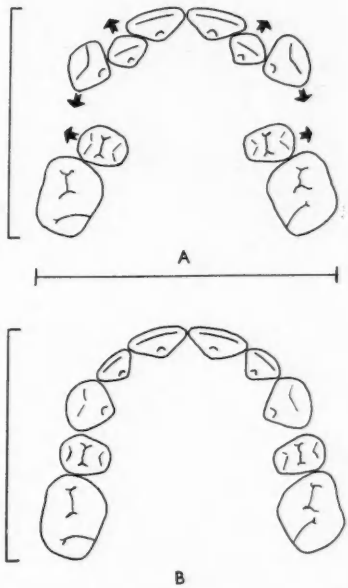

Fig. 2.—Simple or automatic space closure. If the displaced teeth in A are moved, by simple tilting in the direction of the black arrows, situation B results. The lack of strain on anchorage resulting from the type of tooth movement involved means that arch length and width can be easily maintained by a rigid appliance. The vertical and horizontal lines indicate that the main arch dimensions are unchanged during re-alinement. It will be seen in B that a small amount of residual space remains distal to the canines. This space would compensate for slight shift on the anchorage should it take place. Once simple tilting is replaced by a call for bodily movement there will be increased strain on anchorage. If, for example, the canines in A needed bodily retraction, extra anchorage would have to be found. More compensatory space would be needed or else anchorage shift prevented by extra-oral stabilization.

than was actually given at the treatment-planning stage.

The simplest cure of the patient's troubles seemed, at first sight, to be to extract a tooth in the left upper buccal segment and to retract the teeth anterior to the site of extraction so that |3 could be moved distally sufficiently to bring |2 into alinement. The close proximity of |34 apices strongly suggested that the tooth for extraction should be |4. Unless retraction of |4 was accompanied by considerable distal apical movement there would be eventual obstruction to retraction of |3.

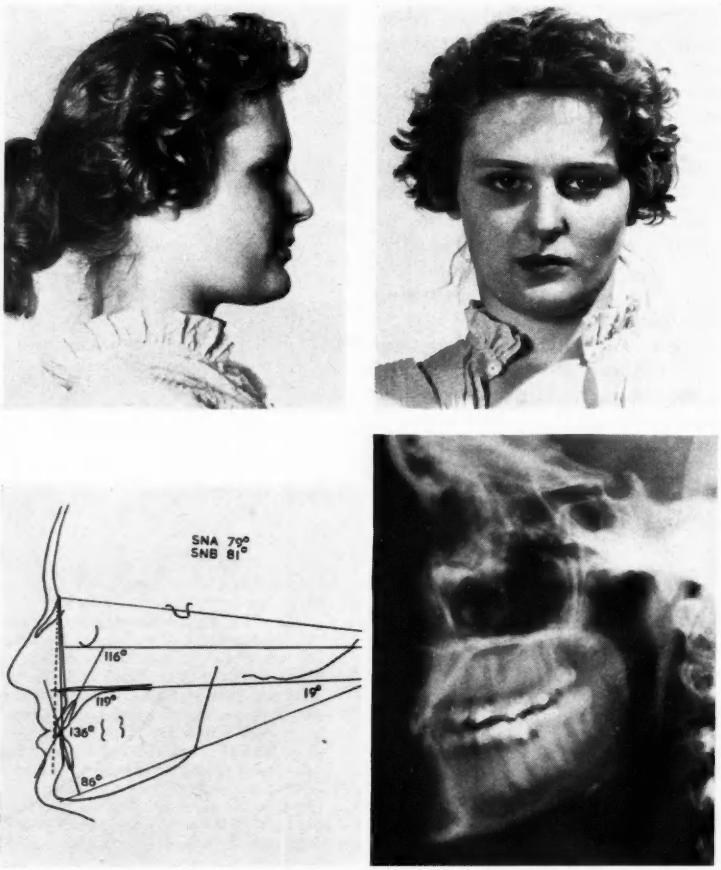

Fig. 3.—Profile and full-face photographs, tracing diagram, and lateral skull X-ray of patient whose treatment is discussed in the text. The patient was 22 years of age and was under treatment for 16 months. It was intended that the incisor relationship should not be altered upper to lower or that the profile should be changed. The dotted line from the N point to the labial surface of the upper central incisor and the angle formed with the SN plane was kept constant in successive tracings as a check on incisor position.

Close study of the plaster models showed a further hazard. If the left upper canine were retracted just the required distance to aline the lateral and avoid spacing, the canine would be brought into cuspal conflict with the mesially

and buccally displaced $\overline{|4}$. $\underline{|3}$ would thus be perched, with marked buccal inclination, on the mesiobuccal aspect of $\overline{|4}$ in a position of doubtful æsthetics and dubious stability.

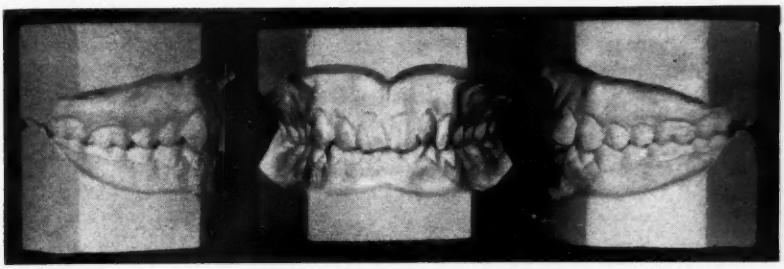

Fig. 4.—Models before treatment. Note position of $\underline{|4}$ apex.

Cuspal grinding, rearrangement of $\overline{|234}$ crowding, depression of $\underline{|3}$, were each considered as a way of overcoming the situation whilst avoiding further extraction, but were rejected on the grounds of either trauma, mechanical difficulty, or loss of æsthetic value. The $\frac{|4}{4}$ were extracted.

With $\frac{|4}{4}$ extracted, more than enough tooth tissue had already been removed to deal with the mild degree of overcrowding present. Nevertheless, with removal of first premolars unilaterally from both arches, one could anticipate a flattening of the anterior curvature towards the side of extractions with a centre-line swing in that direction. Since the upper right canine was somewhat prominent in the original occlusion, the above consideration would mean that in the treated condition it would be made to appear relatively more prominent, and therefore in order to maintain symmetry and avoid further shift of the upper centre line, already to the left, $\frac{4|}{4|}$ were also recommended for extraction.

The above represents the bare bones of the considerations which led to symmetrical first premolar extractions in this particular case.

It was realized at the outset that the extractions would create excess space, and that consequently non-rigid appliances permitting flexibility of movement and control over deliberate anchorage shift were indicated, i.e., one of the full-banded systems. The full implications of the anchorage balance for the whole treatment were not properly assessed at the outset, and treatment was started along what might be described as conventional lines.

Fig. 5.—Occlusal view of models before treatment.

The canine teeth of both arches were separately retracted against anchorage afforded by the posterior buccal teeth until space had been created for incisor alinement. No bodily

movement of the canines was necessary, only tilting, with the result that little strain was, or could be, placed on the posterior anchorage.

Such a treatment approach would be more applicable to a situation where there is little excess space available and measures such as moving teeth individually or in pairs is indulged in to reduce strain on anchorage. Here the reverse was indicated. Had these measures been persisted with in this type of situation the following position would have been created (*Fig.* 6 B): Well-alined upper and lower labial segments correctly related and within muscular balance separated from the posterior segments by half or more of the original extraction spaces, the canines having been moved into no-man's-land.

Anchorage must be found against which to bring forward these posterior segments. If the labial segments are used simultaneously, a double retroclination or "dished in" appearance will result, which would be unæsthetic and probably unstable within muscle action.

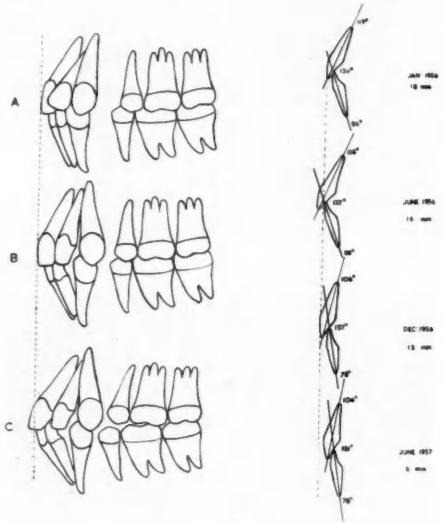

Fig. 6.—A, Represents the original condition following extraction of first premolars and before tooth movement. B, Represents the situation that might have occurred following simple retraction of the canine teeth and alinement of upper and lower anteriors. The incisor relationship is correct and within muscular equilibrium, but separated from the posteriors by considerable residual space. C, Represents the situation that did occur following canine retraction. The inadvertent proclination of the labial segments offers limited anterior anchorage.

Changes that took place to the incisal relationship during treatment are represented in the right-hand column. The total amount of space present is also indicated for each stage. Bodily control of the incisors was not introduced until January, 1957.

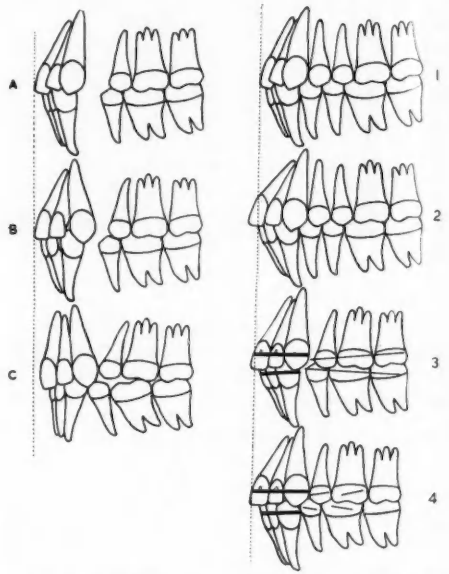

Fig. 7.—A–C show arbitrary space closure without use of anchorage control. 1–4 show the use of anchorage control principles. Begg type, spurred-round archwire or rectangular wire anteriorly. Posteriorly tip backs in various forms combined, in the case of round archwire, with a degree of offset.

Two ways of overcoming this problem might come to mind. First, to stabilize the lower arch with a rigid appliance so that the lower labial segment could give support to the upper whilst the latter was used to afford anchorage to close the upper spacing. Then to use the upper arch, as a whole, as anchorage to close the lower spacing. This would be a slow procedure compared with any method of simultaneous closure, if such could be devised.

Secondly, there is the possibility of providing extra-oral anchorage. It seems unlikely that any such arrangement to close all spacing

simultaneously could be anything other than a little more cumbersome than usual. If these two methods are rejected, one is back in the mouth in search of anterior anchorage, which apparently does not exist.

Returning to the case, errors did not finish at the treatment-planning stage. Through lack of foresight, little interest was shown in the exact positions of the labial segments during initial tooth alinement. These were considered the concern of a later period of treatment and allowed to wander. As it so happened, they were included in the band-up and became unintentionally slightly proclined (2 mm.). Thereby some limited anterior anchorage was inadvertently provided to help overcome the threatened impasse. The posterior teeth could be brought forward using the anterior teeth for anchorage simultaneously until the latter had been retracted to their correct inclinations (*Fig.* 6 C). This resistance would have been negligible if plain round archwires were used, but by the use of archwires that were rectangular in cross-section, close fitting in all brackets canine to canine, the anterior teeth were prevented from tilting and near bodily movement compelled, thus greatly increasing their anchorage value. By resorting to these means in the nick of time, success very nearly resulted.

So nearly was success achieved that it was not difficult, reviewing this case in retrospect, to see where treatment-planning went wrong, and how, in future, in this type of case, one could organize for controlled, intentional, and complete success.

The penalty for incomplete treatment-planning was nearly paid. It should have been envisaged that anterior anchorage would have to be available in quantity if the posterior teeth were to be brought mesially enough to support the labial segments in their original positions and eliminate unsightly spacing (*Fig.* 7).

Extraction of the first premolars might have been delayed whilst commencing the alinement of the upper and lower anteriors by proclination. Once the required degree of proclination for forthcoming anchorage needs had been established the first premolars would have been removed and anterior alinement completed. The permanent canines with their large root areas should have been kept in the anterior anchorage and not separately retracted. The anchorage value of the whole of the labial segments, thus proclined, and inclusive of the canines, should then have been stepped up by the use of rectangular wire or Begg-type vertical loops. Inter- or intramaxillary closing forces should then have been applied between the anterior and posterior segments. Since the former are compelled to move bodily, sufficient resistance would be available to close space largely from behind without the need to promote excessive initial proclination.

Once the closing forces have been applied between the prepared anchorage and the posterior teeth, the object will be to so utilize and alternate inter- and intra-maxillary forces that the labial segments are gradually drawn back towards their correct relationship and equilibrial position and actually arrive there at the precise moment that final space closure occurs. Failure to gauge this exactly will result in either residual proclination or a proportion of double retroclination. It might be mentioned in passing that the prejudging of the anchorage balance to be created by the above measures, at best never easy, is often further complicated by the difficulty of assessing relative muscular influence of lip and tongue on the labial segments.

Thus far, consideration of control and preparation of anterior anchorage has predominated.

Attention must now be given to the behaviour and control of the posterior segments during space closure.

To this end it would be helpful to describe in a little more detail the final mechanical method belatedly employed in the treatment of the patient described earlier. This method is not intended to represent ideal mechanics but will illustrate certain principles.

The archwires used for the space closure stage were edgewise rectangular 0·022 × 0·020 in. To avoid the need for imparting passive torque, promote simplicity of handling, and reduce posterior resistance, these

rectangular archwires were rounded in the buccal regions posterior to the canine brackets. Closing loops were then bent in and the subsequent handling of the buccal teeth was by round archwire approximately 0·017 in. By the use of such an archwire some control was kept over anterior anchorage whilst permitting a degree of tilting of the posteriors during mesial movement. Nevertheless, limited control over the axial inclinations of the posteriors was desirable.

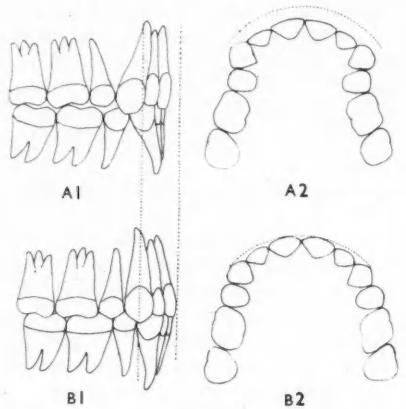

Fig. 8.—A1 and A2 show lateral and occlusal views of uncontrolled movement during space closure. Over-retroclination of labial segments and loss of posterior occlusal contact together with lingual rolling are also shown. B1 and B2 show the desired objective.

The direct mesial pull on these teeth with round archwires causes them to tilt and roll mesially and lingually with apical transference to the buccal of their original positions, and in the process, occlusal contact will be lost. On discontinuation of retention this undesirable state of affairs will either remain, gradually improve with the passing years, or, much more commonly, space will re-open by the posteriors uprighting on their apices in regaining occlusal contact, the length of the apical base being the deciding factor (*Fig.* 8).

Steps must be taken to offset the tilting and rolling if round archwires are used. This is done by a mild degree buccal tip back and offset. These are deliberate adjustments carried through with a view to maintaining the crowns of the posteriors nearer to occlusal contact and rolling the cheek teeth buccally during mesial movement. In other words, a mechanical counter to the natural tendencies (*Fig.* 9).

The buccal tip back, if increased, can also be used to move the apices of the cheek teeth mesially and obtain uprightness. It should be realized in the latter connexion that if the tip back and offset are mild, little more than control of rolling and rotation results. Once the tip back is further increased to cause active mesial movement of the posterior apices, resistance will be immediately increased. The apices will be driven mesially whilst the crowns tilt distally, producing a form of dynamic anchorage useful as a counter to any force pulling forward against the posterior segment.

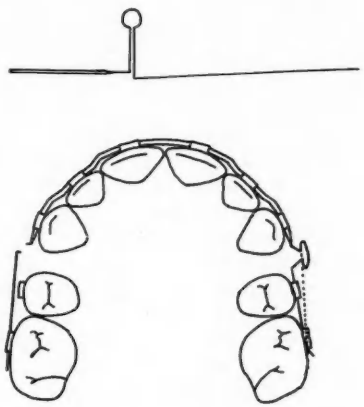

Fig. 9.—The part-rectangular, part-round archwire showing lateral and occlusal views. The posterior section of the archwire is adjusted by tip back and offset to produce a direction of force which directly counters the natural tendencies of the posterior teeth to roll lingually and tilt out of occlusion.

The appearance of these undesirable effects if left uncontrolled is shown in *Figs.* 7 C, 8 A1, A2.

Such posterior resistance was not called for in the case herein described, but would be of great value, for instance, as counterbalance to Class II intermaxillary pull (final models, *Fig.* 10).

It should be acknowledged that the part rectangular, part round archwire technique outlined above is a deliberate simplification of method and is undeveloped when compared with the full edgewise and other established techniques, for example, Dr. Begg's round archwire system. Nevertheless, all these techniques employ the same fundamental principles.

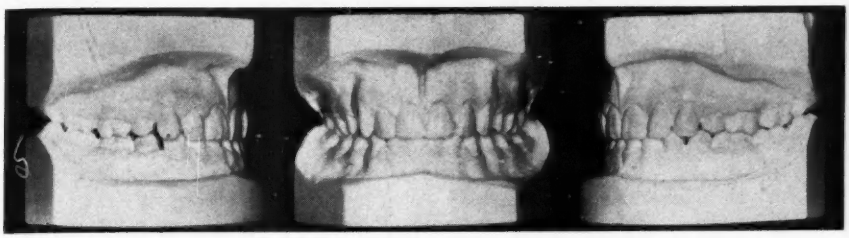

Fig. 10.—Full-face and lateral views of case after completion. Other data have been omitted since neither the actual treatment nor the suggested alternative are of true importance. The case is used as introduction to mechanical anchorage control methods used with the multiband round archwire appliances.

Each technique varies in detail of components, adjustments, method, and handling, all of which affect anchorage judgement. Each separate technique must be the object of detailed study and practice if the orthodontist is to become master.

It is certainly not intended that the impression be left that these fundamentals of anchorage control are confined in their usefulness to certain Class I conditions which happen to have become complicated by a combination of such unusual circumstances as earlier described.

On the contrary, the concept of anterior or posterior anchorage build up is fundamental to control and can be applied to any condition that can be foreseen to need elimination of excess space, whether in one arch or both, or in what classification of malocclusion, and, indeed, whether or not actual space closure is achieved.

To give just one example, comparison will now be drawn between the anchorage balance deliberately contrived in the previous case-history with that which is found ready-made in the Class II, division 1 treatment problem.

It was shown in the Class I condition how a labial segment could be made to offer increased resistance by first deliberately proclining and then compelling bodily movement. The increased anchorage was then used to close unwanted space (*Fig.* 11).

In the Class II, division 1 condition the upper labial segment is found already proclined. If, in addition, there is a call for bodily reduction of the overjet, or for avoidance of forward swing of upper incisor apices during retraction, rectangular or Begg-type spurred round archwire will have to be used to obtain the necessary control. One, then, has the proclined segment compelled to move bodily and, as has been seen, such resistance will cause anchorage shift to any intra-oral force.

If, therefore, an intra-maxillary force is applied between the upper labial segment and the upper posteriors, space for the overjet reduction will be lost from behind. If an inter-maxillary force is used between the upper anteriors and an intact lower arch, the entire lower arch will move mesially with the undesirable proclination of the lower labial segment, resulting in probable ultimate lower arch relapse. If space is created which is sufficient to compensate for lower anchorage shift, the teeth of the overjet can be retracted into the upper premolar spaces by pitting them, by Class II mechanics, against the lower posteriors. In this instance, marked tip-back bends are incorporated into the posterior of the lower archwire to cause increased resistance to the elastic pull by

driving the apices of the lower posterior teeth mesially. The upper posteriors are stabilized against mesial drift by similar but milder tip backs. The lower labial segment is stabilized against possible proclination that might result from posterior bracket to archwire frictional resistance by availability of an intra-maxillary force. The posterior tip backs not only afford control and temporary increase of anchorage, but also cause gradual repositioning of the apices into desirable locations for case completion.

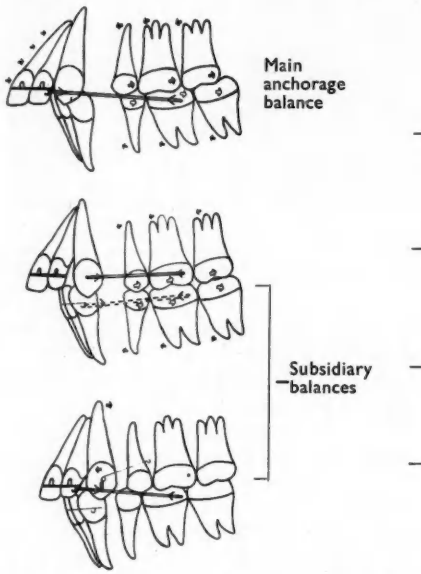

Fig. 11.—Arrows show anchorage control caused through archwire adjustments. Black arrows show positive movement, the outlined arrows where this movement is countered by another force. Subsidiary and main balances will be run concurrently. The subsidiary balances shown above relate to canine retraction and apical re-orientation, and to the need for availability of lower intra-maxillary traction to prevent incisor proclination due to posterior bracket to archwire locking that may occur during use of Class II mechanics.

Just as in the Class I case so here in the Class II, division 1 the object will be so to adjust the forces that the labial segments are returned to their correct positions at the precise moment that spacing is eliminated in both arches.

Throughout the observations on the methods of multiband therapy, bodily control of a tooth has been referred to as producing increased anchorage resistance. This is true, but it should not be thought that the act of preventing a tooth from tilting automatically transforms the supporting tissues into concrete, or that causing distal tilt to posterior teeth by tip-back bends gives increased resistance by virtue of the new angulation.

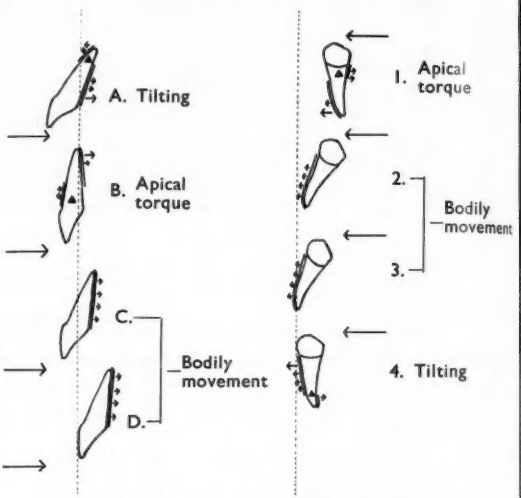

Fig. 12.—Illustrates the retraction of an upper incisor and forward movement of a lower premolar towards a given line. Differential pressures are used in two different orders, both with a view to obtaining maximum anchorage value from the tooth concerned. The small arrows indicate distribution of pressure and the small black triangles the pivotal points.

Fig. 12 is appended to show how the maximum anchorage obtainable from any given tooth stems from the root area and the total distance that root can be compelled and permitted to move bodily through bone. The full bodily shift can be brought about either by a gradual, even distribution of pressure over the entire length of the root, or by applying pressure at one end of the root and then at the other. In bodily movement, or where apical torque is applied, the crown is prevented from the rapid change of position that occurs when tilting is permitted. Such control over the

crown position represents a gain in space and time occlusally—a fact which can be turned to practical advantage.

SUMMARY

The ideal situation in mechanical therapy is where circumstances allow, or by thoughtful treatment-planning can be made to allow, for full reciprocity of appliance action whereby both action and reaction are beneficial to the ultimate objective. In this way wastage of time and appliance effect is reduced to a minimum. This means the provision of an ideal anchorage balance which in turn will mean that, in the extraction case, these be carried out at the right time, the right place, and provide the right space.

The judgement of such ideals will depend on the orthodontist's ability to assess all factors pertaining to anchorage, whether natural or artificially created. Unfortunately, he will find, despite planning, that the perfect balance is elusive, and that all too frequently circumstances arise to render impossible perfect harmony between any selected extractions with any appliance method. Occasionally, circumstances prevent extraction in the ideal location for balance. This imbalance leads to protracted treatments, either by increasing the quantity of tooth movement, or increasing the difficulty of mechanical control, or both.

More commonly, the ideal balance cannot be obtained because one is compelled to remove whole units. The amount of space rather than the location is wrong. The orthodontist will, in these circumstances, be confronted with one of two mechanical problems. When faced with space barely adequate for his needs, his problem will be the preservation of anchorage stability. When space created is substantially in excess of his needs, the problem will be one of controlled elimination of the unwanted space.

Appliance systems tend to fall into two groups, which by virtue of basic design lend themselves to the solving of these several problems. These groups are not fixed and removable. Such aspects of design have no true significance. The groups could more accurately be described as "rigid" and "flexible".

Removable and labio-lingual appliances are examples of the rigid variety; the rigidity being imparted through a framework or "body" of stout wire or acrylic. These types lend themselves to maintaining arch length and width and anchorage stability. They are also comparatively limited in their capacity for simultaneous tooth movement, particularly where control over the long axes of the teeth is concerned. Through reduction in quantity of simultaneous direct action and use of bulk anchorage, the reciprocal effects are limited and slow to form. The direct and indirect action of these appliances are, therefore, not difficult to interpret in advance, and little excess space will be needed to compensate for the slight anchorage shifts likely to occur. Furthermore, in cases where no shift whatsoever can be permitted, extra-oral traction counterbalance can be added to the rigid type appliance without curtailing efficiency or reducing the potentiality of the apparatus for simultaneous tooth movement.

The significance of the frequent reference to the potential of appliances for simultaneous tooth movement lies in the influence this has in reducing overall treatment time. Treatment periods are shortened not by moving individual teeth more rapidly, but by moving more teeth simultaneously in the appropriate directions.

When confronted by the problem of closure of substantial amounts of excess space, the simple rigid appliance is at a disadvantage. It becomes difficult with this type to move part of the anchorage more than another, and there is lack of control over the long axes of the teeth. More flexibility is required throughout the dental arches so that groups of teeth can be moved precise distances quickly, whilst at the same time providing better control to each tooth individually. The flexible types of appliance contend with these requirements and provide the obverse side of mechanical tooth movement. What has been said of the rigid variety can now be reversed.

The multiband systems, possessing no wire or acrylic "body", provide anchorage flexibility and are suited to deliberate independent

movements rather than general stabilization. Their potential for simultaneous tooth movement is unrestricted, and control over the long axes of individual teeth is provided. Because of this latter factor, these appliances are commonly used to effect rotations and change of apical positions, and to control bodily movements—the very tooth movements likely to place the greatest strain on anchorage. Marked shift of anchorage can often be anticipated with the flexible appliance, and excess space to compensate must be provided in the extraction case. Attempts to maintain anchorage stability by extra-oral traction counterbalance in association with multiband appliances may well be only partially successful and may even damage the apparatus. This is particularly true of the fine, round archwire techniques.

The foregoing material is intended to suggest that rigid appliances are seen at their least efficient when attempting to close excessive residual space. The flexible variety are at their least efficient in company with bare adequacy of space, and need excess space for full efficiency. A hint has also been dropped that it is the anchorage judgement side of multiband therapy that is difficult, rather than the technical aspect. Unhappily it is not possible within the scope of this paper to draw conclusions. Due reflection may persuade the thoughtful reader that these could be numerous.

Finally, should the views expressed herein be read with steadfast disbelief, it is the author's sincere hope that his attempt to dissociate fundamental appliance principles from technique detail will not go unnoticed.

The diagnostic side of orthodontics was, until the realization of the basic importance of the variation of bone and muscle patterns, a conglomeration of uncorrelated symptomatic material. On the practical side of the subject some similar understanding on basic issues is still required. The appliance field will remain a pool of multitudinous, uncorrelated machinery to many a practitioner until more emphasis is laid on fundamental principles rather than on individual methods and techniques.

DISCUSSION

The President said that the paper gave some idea of what students were up against! He invited Mr. Adams to open the discussion on the paper.

Mr. C. P. Adams said that the problem of residual spacing at the end of orthodontic treatment, in which teeth had been extracted, was one that worried everyone from time to time. Those who used removable appliances might worry because they did not have fixed appliance technology at hand. On that point he agreed with Mr. Fletcher, in that distinction between the terminology regarding appliances—rigid appliance versus flexible appliance—was an important kind of distinction. The only caution he would add was that in spite of the multiplication of terminology, perhaps they could agree on that distinction in a suitable form.

Those who used immovable appliances or rigid appliances felt worried because they had not the flexible type at their command, and those who used the flexible type might feel uneasy because they were so ill-equipped. The availability and capacity to use multiband appliances might carry with it a kind of implied obligation to close every space in sight, regardless of all other considerations.

He agreed most heartily with Mr. Fletcher's dissociation of treatment rationale from technical means and his insistence on the need to think clearly first of all about what was to be done and then about the way in which to do it. The idea that a philosophy, doctrine, or rationale of treatment implied unavoidably the use of specific technical means was most confining, and if devoutly followed, led, in time, to a blindness to the real issues that were involved.

Spacing was a natural condition in some dentitions, and when it was found to occur, in those circumstances, it was accepted. Furthermore, such spacing usually occurred in the labial segments where it was most easily seen. The difficulty was that while the responsibility for the occurrence of natural spacing could not be laid at the door of the orthodontist, space left over at the completion of treatment which involved extraction of teeth could be pointed to as an undesirable by-product which, it might be suggested, had to be got rid of at all costs, particularly if such spacing was visible in everyday life.

As Mr. Fletcher pointed out, at the planning stage of treatment there should be consideration of the relationship of the amount of space that would be created by the removal of teeth to the amount of space that was actually required for the final repositioning of teeth mesial to that space. From that would follow the estimation of whether there was need or not to close residual space from behind to produce interproximal contact.

The proportion of cases in which the amount of space created by extraction exactly matched the amount of space required for the alinement and repositioning of the arch mesial to the space must be quite small. Why was it, therefore, that consideration of space closure mechanically had not featured more in orthodontic literature in the British Isles? There were two answers to that question. One was the belief that if it was possible to produce a

satisfactory functional and æsthetic result without multiple and extensive tooth movements, there was much to be said for doing so. Secondly, the tendency for teeth in the buccal segments to move forward if relieved of their interproximal contact in front was well known, and reliance on that tendency, which persisted for a considerable time, was not always ill-founded, and it provided the necessary space-closing factor in many cases.

The question of space closure following extraction in the buccal segments could not be considered without reference to the site of extraction, although sometimes, when extraction was mentioned, extraction of the first premolars was meant. It was, however, misleading to discuss the control of space closure as a general topic and only to make reference to the closure of the first premolar spaces. The extraction of other teeth in the buccal segment had long been practised, and if extractions of necessity because of caries were ruled out, teeth other than first premolars had been selected for extraction largely because of the problem of residual space. The advantages of the removal of teeth farther back than the first premolars were that, if space was left in the end, it would not adversely affect the result æsthetically. Secondly, the likelihood of space remaining at all was very much reduced. The corresponding disadvantages of tooth misplacement in the buccal segments by rotation and tilting might occur, but those might be dealt with, if thought necessary, by multiband appliance therapy, and at that stage a choice of treatment or no treatment for correction of such rotations was still open.

The subject Mr. Fletcher had put before them concerned a situation that every orthodontist had to face from time to time, and Mr. Fletcher had done good service in bringing the matter to discussion in the Society.

Mr. F. Allan said he was particularly interested in the paper because space closure on the whole was not taken very seriously. If there was already a space existing in the lower arch and there was crowding in the anterior labial segment, it was not considered necessary for dental fitness to move those teeth into the gap.

Another thing about closure of space was that one saw spacing anteriorly in many cases with crowding and overlapping persisting posteriorly unless these spaces were closed. This had to be considered from the point of view of failure of treatment after a number of years.

Mr. J. H. Hovell said that Mr. Fletcher's paper contained a mixture of common-sense opinions with quite a lot of technique. There were two problems in space closure: one was to close the space, and the other was to make sure that, when it was closed, it stayed exactly as it had been put. Mr. Fletcher had pointed out that by uneducated techniques in which anchorage was not fully considered, when the incisors were rotated and cheek teeth tilted, the spaces were apt to open up again when treatment was finished. If a space was going to open up after it had been closed, it would have been better not to have closed it at all from a point of view of oral health. He thought that a lot of closure of spaces was undesirable unless they were properly closed. The whole point of the tip-back bends on buccal segments was that, when the appliances were taken out, those teeth, by occlusion, tended to be tilted forward a bit, so the space closure remained, the cheek teeth were tilted forward by occlusal forces against the labial segment, and space closure was maintained. It did not open up, and one did not get the frightful result when a space was closed up and opened up a little bit. That was the main disadvantage of poor space closure.

He thought that Mr. Fletcher had debunked slightly the tip-back bend in providing anchorage, and pointed out that it was the sum total of the movement of the teeth that really mattered, and not when it took place. They had a lot to learn from Mr. Fletcher and he thanked him for his paper.

The President said that it seemed to him that the main lesson that might possibly be learnt from the paper was the importance of trying to avoid treating cases on a "catch-as-catch-can" basis. The emphasis that Mr. Fletcher had laid on the overall planning right from the outset had been very valuable. He well remembered that, as a young general practitioner orthodontist, how often one did a year's treatment and then did not know what to do in the second year. One got a certain way with the case, and then had to try to dream up something to finish it off.

Mr. Fletcher had shown very clearly what an unwise process that was.

Professor G. E. M. Hallett said that, arising out of the case shown by Mr. Fletcher, there seemed to be a difference in size between the teeth on the one side and the teeth on the other. Mr. Fletcher had not referred to it, and it might have been an optical illusion, but there seemed to be a difference in crown morphology between the molars and the premolars on the more crowded side. The molars on the left side seemed to be larger with an interestingly different crown morphology from those on the right-hand side. He would be interested if Mr. Fletcher had any comments on these observations.

Mr. D. J. Hartley applauded Mr. Fletcher's analytical approach to the problems of space closure. It was a fundamental method of approach which might be much more widely applied to orthodontic problems. He was a little puzzled on one point, and hoped Mr. Fletcher could help him. Why had he taken the trouble to round the posterior sections of the rectangular wire, then to be faced with the problem of lingual rolling of the premolars and molars? Surely, had he not rounded the wire, that problem would not have arisen.

Mr. Fletcher, replying, said that he felt privileged to have Mr. Adams to open the discussion.

Amongst the observations that he had made was the matter of space closure through natural causes. Mr. Fletcher said that this was a well-recognized phenomenon, and occurred readily in cases that happened to possess appropriate size of dental base and favourable individual apical positions of the teeth. He had, however, deliberately ignored this aspect as too obvious and had concentrated on space closure in less favourable circumstances.

Mr. Fletcher, continuing, said that he had not meant to be misleading by alluding only to first premolar extraction. Naturally, if alternative extractions provided a more favourable balance of anchorage this would be done in preference to facing mechanical complexity. Nevertheless, the basic problem of providing too much or too little space would still arise.

With regard to the closure of space anteriorly having a more important link to facial æsthetics than residual buccal spacing, Mr. Fletcher agreed that this was so and might alter mechanical detail but not the fundamental problem.

On the subject of whether the anchorage resistance of a labial segment would remain the same even if it were not first proclined, Mr. Fletcher said resistance would always be the same for bodily movement of the same

teeth over the same distance. He thought that the benefit of proclining was one of easing the mechanical aspect of initial alinement and represented a gain in time and space occlusally.

Replying to Mr. Allan, Mr. Fletcher said he doubted whether some authorities would take such a perfectionist view of space closure as he had. They could scarcely bear the cost of the work involved, and would have to rely more on natural space closure and accept residual space wherever the individual merit of a case permitted.

Answering Mr. Hovell, Mr. Fletcher said that space re-opening after treatment was always damaging to an orthodontist's pride in achievement, but not necessarily detrimental to the result as a whole. The important factors preventing such relapse were in adjudging correctly the equilibrial position of the segments, particularly the labial, the re-adjustment to proper axial inclination, and the maintenance of occlusal contact.

Mr. Fletcher thanked the President for adding emphasis to his remarks on treatment-planning. It was of incalculable value to have the stages of treatment envisaged from start to finish. One should know what was going to happen and not rely on visit-by-visit inspiration.

In thanking Professor Hallett for his observations Mr. Fletcher said that he had not noticed any difference in crown morphology in the case reported, but would check on this point.

Mr. Hartley had asked why the rectangular archwires used in the treatment of the patient featured in the case report had been rounded in the buccal regions. Not to have done so would have resulted in the use of full edgewise technique involving such matters as the imparting of passive torque requiring time and great accuracy. The use of part-round archwires avoided this. It should be remembered that the precision of the edgewise mechanism must be matched by immense accuracy on the part of the operator. This happy union all too seldom occurred. Round archwire techniques had their shortcomings, but ways and means were being found to counter these. The fine round archwire technique propounded by Dr. Begg, for example, seemed scarcely less effective than edgewise and in due time some such method may prove the simpler of the two.

TREATMENT OF ORAL LESIONS WITH QUININE BISULPHATE

"Herpetiform" lesions occur in both children and adults, and in the former the most common is the primary herpetic stomatitis from an infection by the herpes simplex virus. This is manifest as a gingivitis, raised temperature, fœtor, and on the mucous membranes of the lips, cheeks, gingivæ, and tongue there are raised vesicles which soon rupture and become yellow-grey on a red swollen background. The disease lasts from 7 to 14 days and the child is quite ill.

A variety of names has been used for the disease in the adult, and one commonly known, aphthous stomatitis, applies when the lesions are single and discrete. The aetiology is obscure, but the opinion is held that individuals who have had even a slight herpes infection play host to the virus throughout life, and it may become active by emotional upsets, trauma, and allergy.

None of the methods of treatment hitherto used has been particularly effective. Quinine bisulphate, 6 per cent solution, is put forward, not as a curative agent, but as one which shortens the duration of the lesions and reduces discomfort almost immediately. It is used here either as a mouthwash or as a topical application according to the severity of the condition, and the application either way may be made 4 to 6 times daily. The drug is a mild antiseptic and is not hindered by pus. It appears to have a topical anæsthetic action as well as styptic, stimulating, and sclerosing actions on the ulcerations of the mucous membranes. It has no deleterious effects on the teeth and soft tissues of the mouth. It is prescribed by the dentist for local dental treatment only, and it may be used by the patient at home. In this survey, 50 cases were treated and there were 2 failures.—DE VRIES, J., and FRANCIS, L. E. (1960), *J. Canad. dent. Ass.*, **27**, 88.

G. E. B. MOORE

LETTER TO THE EDITOR

November 10, 1961

Dear Sir,

It is heartening to note that the expanded metal tray impression technique, which has been popular with many general practitioners for a number of years, has at last been written up by a member of the staff of a Provincial Teaching School (E. K. Joseph, DENTAL PRACTITIONER, October, 1961). Neither in the text nor in the beautifully produced illustrations does one observe that the sharp, spiteful edges of the trays are covered with a protective such as dentina wax or low-fusing composition. This precaution against accidental trauma is essential for the comfort of the patient.

Yours faithfully,
ERIC A. SCHER

"*Tranquilla*",
288 *Ditchling Road*,
Fiveways,
Brighton, 6